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Contents

National Academy of Sciences: *Abstracts of Papers Presented at the 1951 Annual Meeting* 473

Technical Papers

Transmission of *Plasmodium relictum* Grassi & Feletti by *Anopheles freeborni* Aitken: *F. F. Mok* 485

Inhibitory Effect of Cortisone on Dietary Necrotic Liver Degeneration in the Rat: *Klaus Schwarz* 485

The Anterior Process and the Ossification of the Malleus in Mammals: *Kamal Wassif* 486

Barrier Island, Not "Offshore Bar": *W. Armstrong Price* 487

A Device for Air Evacuation from an Autoclave Sterilizer: *Chen Lu-ao* 488

An Enzyme in Endocrine Tissues which Oxidizes Δ^5-3 Hydroxy Steroids to α,β Unsaturated Ketones: *L. T. Samuels* et al. 490

Morphology of the Ovary of *Oryza Sativa* Linn. Var. *Plena* ("Double Rice"): *R. M. Datta* and *A. K. Paul* 491

A Root Disease of Plants Caused by a Nematode of the Genus *Trichodorus*: *J. R. Christie* and *V. G. Perry* 491

Attempt to Show Diffusion of Essential Growth Factors from an Induced Penicillin-resistant Culture to the Parent Penicillin-sensitive Strain: *J. L. Stone* 493

An Antidiuretic Substance Obtained by Digestion of Globulin with Pepsin: *H. Croxatto, G. Rojas,* and *L. Barnafi* 494

An Internally, Electrically Heated, Sintered Glass Filtration Disk: *Arthur D. Mack* 495

Association Affairs

Gordon Research Conferences: *W. George Parks* 496

News and Notes 501

More Probes into Interstellar Space 3

Meetings & Conferences 8

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by

James GILLULY, *U. S. Geological Survey*
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CONTENTS: 1. Introduction; 2. The Earth's Broad Pattern; 3. Gravity, Isostasy, and Strength; 4. Minerals; 5. Rocks; 6. Climates, Weathering, and Soils; 7. Erosion; 8. Geologic Maps, Fossils, and Time; 9. Movements of the Earth's Crust; 10. Records of Earth Movement; 11. Downslope Movements of Soil and Rock; 12. Stream Erosion and Deposition; 13. Glaciers and Glaciation; 14. Ground Water; 15. Deserts; 16. Oceans; 17. Igneous Activity; 18. Earthquakes and the Earth's Interior; 19. Mountains; 20. Mineral Resources. Appendixes: I. Techniques of Topographic Mapping; II. International Atomic Weights; III. Identification of Minerals; IV. Identification of Rocks. Index.

Dr. Robert R. Compton of the Stanford geology staff has done all the drawings for this text.

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More Probes into Interstellar Space

From the cosmic ray physicist has come a new and important contribution to our knowledge of the interstellar medium. We have long accepted the evidence that a large percentage of the energy of the universe is carried in the cosmic rays. But we still do not have any acceptable theory of the origin of cosmic radiation. Does it come from the original hypothetical explosive event that produced stars and galaxies some thousands of millions of years ago? Or does it come as a by-product of the supernovae, or of the "flare" stars? Or does cosmic radiation originate in the interstellar dust, assisted by the machinery of magnetic fields? Or is it perhaps somehow generated from the sun and its atmosphere, and manipulated by magnetic fields of earth and sun?

Cosmic rays at the earth's surface are mostly of secondary origin—the products of the violent interaction of primary cosmic rays from outer space and the atoms of our upper atmosphere. But the high-flying balloons that leave most of the earth's atmosphere below them are now richly in touch with primary radiation. Thanks to the skillful efforts of Minnesota and Rochester investigators, these speed-of-light particles that we call cosmic rays are found to contain not only the nuclei of hydrogen atoms (protons) and helium atoms, but the nuclei of many of the heavier elements. In other words, the nuclei of elements such as carbon and iron are impelled by some means to hurtle through space with light velocity and help produce the penetrating radiation measured at the earth's surface.

An extraordinarily interesting new development is due to Bernard Peters and his fellow-investigators at Rochester. They are now able to make a chemical analysis of cosmic radiation, detecting the hydrogen, helium, carbon, nitrogen, oxygen, and other elements, going in weight up to, but not as yet passing, the atoms of iron. The relative abundances of the various atoms found through the measurements of cosmic rays are comparable to the abundances throughout the universe found in other ways. There are some anomalies that incite further work and further discovery, such as the scarcity or absence of neon in the sun's atmosphere, and its considerable abundance on the earth and in cosmic radiation.

Again a new tool for exploring space has been developed—a tool scarcely imaginable a decade ago. It has come from a liaison of the sciences—electronics, cosmic chemistry, astronomical spectroscopy, and the counting of stars on stellar photographs.

Also from outside the main lines of astronomical work there has come in recent years the marvelous development of radio astronomy. The new science has gone far since the first work on the character of radio echoes from the ionosphere, which intimated that shooting stars in those atmospheric strata are responsible for the sudden ticks and jerks in signal strength. The early work also involved Milky Way static and the bouncing of radio signals off the moon. There is increasing activity in this field in the United States, where much of the basic pioneer work was done, but we must give top credit to the Australians, the English, and the Canadians.

We now have in radio (microwave) astronomy one of the most potent tools imaginable for the detection of meteors, since radio echoes can reveal in daylight, through clear sky or clouds, as well as at night, the innumerable meteors that the photographic plate cannot catch, or the eye see. The electronics engineer has opened a new epoch in the astronomy of the dust particles of our atmosphere.

A few years ago the words radio star made no meaning at all. Now we have a list of three or four score of these mysterious spots among the stars, where no star can be seen, but from whence come meter-length radio signals. In addition, we now have on record a general "Milky Way Static," and the new large equipment is beginning to work on the radio waves from around sunspots.

Harlow Shapley

Harvard College Observatory

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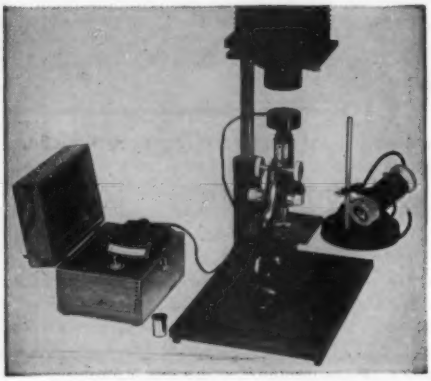

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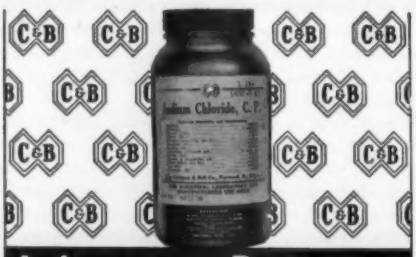

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Role of the Spleen and Nonsplenic Sites in Antibody Formation

William H. Taliaferro and Lucy Graves Taliaferro
University of Chicago

Further studies have been made on hemolysins (determined photometrically in 50% units) in rabbits following intravenous injections of sheep erythrocytes. The relative importance of nonsplenic sites in forming antibody increases with the amount of sheep cell antigen injected, as indicated by a comparison of daily and peak titers in intact and splenectomized animals. Furthermore, the effects of splenectomy are reversed in multiply- as contrasted to singly-injected rabbits. Thus, splenectomy resulted in a decrease to about 20% in the peak titer after a single intravenous injection of 1.25 ml of 1% sheep cells, whereas it resulted in an increase to 300% after 10 similar injections. The most likely explanation of the lower production of antibody in multiply-injected intact animals as compared to splenectomized ones is that the spleen is in a refractory phase, but continues to remove antigen from the blood before it reaches nonsplenic sites. After a single antigen injection, the spleen forms most of the antibody and abruptly passes into an inactive phase partly due to lack of antigen. After intensive antigenic stimulation, the spleen forms about 3 times as much antibody and then enters a refractory phase during which it fails to respond to frequently repeated antigen injections. During the same intensive immunization, nonsplenic sites in intact animals may produce 20 times as much antibody, and in splenectomized animals even more.

Locomotion of *Chaos chaos*, the Giant Ameba

Warren H. Lewis, *The Wistar Institute*

Chaos has two gel layers, a complete thin outer plasmolemma and a thick plasmogel which encloses, except at pseudopod tips, fluid plasmosol. Gel layers always exert contractile tension. Contractility, not elasticity as is usually assumed, is the motive force of ameboid movements and plasmosol streaming. Contraction of posterior plasmogel forces plasmosol forward against weak plasmolemma pseudopod tip and expands and advances it. Tail is pulled forward and anterior plasmogel backward. Gelation on inner aspect of plasmolemma tip prevents its rupture. As posterior plasmogel contracts it solates into plasmosol. Anteriorly plasmosol deflected by the plasmolemma tip to the sides gels and prolongs gel layer forward faster than it is pulled backward. This is the sol-gel cycle—contraction and solation at posterior end, advance and gelation at anterior end. After pseudopods have advanced for varying distances free in the surrounding water, they may retract or bend to the substratum and become temporarily adherent to it by their tips. Old attached pseudopods are released, retract, and eventually become part of the irregular tail end. There is an irregular succession of varying numbers of new advancing and retracting pseudopods. Adhesion is essential for locomotion. Without it the sol-gel cycle (fountain streaming) continues, but the ameba does not migrate. This is illustrated by scenes showing an ameba with a large persistent anterior vacuole. Behavior of charcoal granules indicates that they are pulled along by an invisible layer of secreted slime and not, according to the usual concept, by plasmolemma.

The Red Blood Cell as a Chemical Reagent

M. H. Jacobs, *University of Pennsylvania*

Special properties of the red blood cell (which are discussed) permit its use both as a simple chemical reagent and as an indicator of the progress and end points of a variety of chemical reactions. Changes of shape of the red cell affect the optical properties of its suspensions in a manner that is visible to the naked eye and may readily be photographed. Such changes may conveniently be produced by as little as 0.01 mg of certain surface-active substances. An impurity in so-called chemically pure sodium chloride, later shown by Ball to be silver, was discovered by its characteristic hemolytic action on the red cells of certain fishes. The nature of this action has been further investigated. A highly specific effect on the permeability of human red cells to glycerol permits the detection of copper at a concentration equivalent to 1 mg in more than a barrel of solution, and quantitative measurements of actual amounts of less than 0.1 γ. The characteristic type of permeability of the red cell to ions furnishes a test for ammonium salts which is positive and quantitatively useful at concentrations as low as 0.00003 *M*. Tannic acid at very high dilutions changes the permeability of red cells to anions in a way that can be used for the indirect determination of minute amounts of substances such as proteins and organic bases with which it combines. Other examples involving similar principles are known, and the list is doubtless capable of extension.

Induction of Mutations in *Escherichia coli* by Manganous Chloride

M. Demerec, *Carnegie Institution of Washington*

Tests with *E. coli*, in which induced mutants involving phage resistance and streptomycin dependence were studied, revealed that $MnCl_2$ is a very potent mutagen. It was found that the degree of mutagenic effect of $MnCl_2$ is greatly influenced by the condition of the treated bacteria. Its effectiveness is reduced if before treatment the bacteria are washed in water. Washing in a hypotonic solution of NaCl, KCl, $CaCl_2$, sodium lactate, or sugar (lactose, dextrose, sucrose) also decreases the effect, whereas washing in a hypertonic solution of any one of these chemicals increases it. The effect is slight if the bacteria are grown anaerobically, or if they are treated when in the growing stage. Magnesium suppresses the action of $MnCl_2$, which is also affected by the temperature during treatment, the concentration of $MnCl_2$, and the duration of treatment. The mutagenic effect of $MnCl_2$

cannot be reversed by subsequent washing. Results obtained so far indicate that it depends on the intake of the chemical by the treated cells, and on the amount that is bound in a certain way by these cells. Identical treatment with $MnCl_2$ may induce from 0 to 2×10^4 mutants per 10^8 treated bacteria, depending on the condition of the bacterial cells.

Effect of Total Removal of Liver on Free Amino Acids of Plasma

Frank C. Mann and Associates, ***Mayo Foundation***

The objective of many of our investigations on the liver is to seek a method for quantitating one or more functions of the organ which could be used clinically. The technique of paper chromatography offered a new tool with which to continue such investigations, because the free amino acid content of blood, tissues, and urine increases after total removal of the liver.

In the present investigation the liver was completely removed from dogs by an appropriate technique, and the necessary amount of glucose was injected continuously. Specimens of blood and urine were obtained before operation and at the end of the experiments, which occurred 15–30 hr after hepatectomy. A comparison of the chromatograms of the specimens indicated an increase in the concentration of many amino acids in the plasma after total hepatectomy. Increases in the concentration of these amino acids were not found in control animals receiving similar injections of glucose. The relative distribution of individual amino acids was not greatly altered, and the increase occurred in both the essential and nonessential amino acids. No amino acid or its derivative appeared to increase predominantly or at the expense of other amino acids.

Rhodopsin and Visual Excitation

George Wald and Paul K. Brown, ***Harvard University***

Light striking the retina of the eye bleaches the pigment of the rods, rhodopsin. This is a complex process, initiated by a photochemical reaction, followed by dark changes. Ultimately it breaks rhodopsin into a mixture of the protein, opsin, and the yellow carotenoid, retinene. Somehow this process, probably in its first stages, leads to a nervous discharge which, transmitted from neurone to neurone to the brain, ends in the production of visual sensations. At all levels the response is manifested by electrical changes—action currents in the retina, optic nerve, and brain. Each of these structures presents in turn the fundamental problem of excitation—how a stimulus evokes the electrical changes that constitute the response.

We have found that the bleaching of rhodopsin by light exposes new sulfhydryl groups on opsin, two such –SH groups for each molecule of retinene liberated. The sulfhydryl group is highly reactive; it is weakly acidic, readily binds metal ions, and is a strong reducing agent. Through all these properties it can be made to yield electrical effects.

For example, a rotating platinum electrode in a solution of silver nitrate, connected through a salt bridge to a mercury-mercuric iodide half-cell, generates an electric current proportional in strength to the concentration of silver ions. This arrangement can be used to measure sulfhydryl groups, for the latter by binding silver ions lower the current (Kolthoff and Harris). If rhodopsin is titrated with silver ions in the dark in such a cell, the current remains minimal until all –SH groups are removed. On adding further silver ions, the current rises. On bleaching the rhodopsin with light, new –SH groups appear which remove silver ions, and the current falls again. In this way the bleaching of rhodopsin results directly in an electrical variation.

We are exploring potentiometric and polarographic variants of this phenomenon, and possibilities of casting it into forms which mimic physiological systems. In the liberation of reactive chemical groups by a stimulus, and the ionic rearrangements which follow, it may provide a general model of the excitation process.

Replacement of Thyroxin by its Nitro Analogue (3,5,3′,5′-Tetranitro Thyronine)

Fritz Lipmann and Charles H. DuToit
Massachusetts General Hospital

The nitro analogue of thyroxin which, for a long time, we had hoped to test was made available to us through the generous cooperation of B. A. Hems, of the Glaxo Laboratories Ltd., of Greenford, Middlesex, England. It contains nitro groups in the same positions on the thyronine skeleton, where the product of the thyroid gland contains iodine. The compound was tested on thyroidectomized rats. The animals were used when their growth had stopped and a low metabolic rate had developed. They showed thyroid-deficiency signs, including scaliness of tail, caked eyes, and a rough fur. On injection of 25 mg of tetranitro thyronine, in a single or a once-repeated dose, the growth resumed for 2–3 weeks. The deficiency signs receded, and the metabolic rate rose to normal levels. One animal, after receiving 25 mg twice, showed a transient exophthalmic reaction. The nitro analogue appears to be about 1/100 as active as the iodothyronine (thyroxin). Activity of the nitro compound suggests that the specific action of the hormone may depend on a strong negativity of the substituents on the phenolic ring system, rather than on their specific halogen nature. Other studies on the metabolic action of the thyroid hormone are in progress in this laboratory, and are discussed briefly.

The Role of Electroosmosis in Living Cells

L. R. Blinks and R. L. Airth
Hopkins Marine Station of Stanford University

The possible role of electroosmosis in the movement of water through living cells has been tested in *Nitella*, where the magnitude of bioelectric potentials is known, definite voltages can be applied to known cell surfaces, and current densities calculated.

In the range of normal bioelectric potentials (up to 100 or 200 mv), no appreciable movement of water is produced through the cell. This is true up to considerably increased applied potentials (e.g., 1.5 v), which are still tolerated during brief exposures. Current densities may be 0.05 ma/cm² of surface.

With large applied potentials (5–40 v) giving current densities up to 5 ma/cm² of cell surface, larger effects are produced. In some cases differential damage occurs, allowing intake of water (probably by osmosis) at the less damaged end of the cell. This continues when the current is stopped or reversed, but disappears as the cell

dies. It can be greatly decreased by bathing the cell in an isotonic nonelectrolyte (e.g., mannitol).

In a completely dead cell, true electroosmosis appears as the salts diffuse away, if sufficiently large currents are passed.

It is concluded that electroosmosis is a minor factor in the movement of water in the normal cell.

Blood-Group Specific Hemagglutinins from Plant Sources

William C. Boyd, *Boston University*

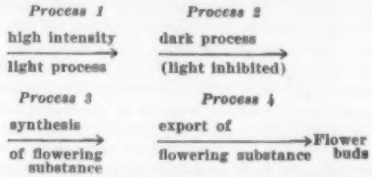
For a long time it has been known that agglutinating substances could be extracted from certain seeds, for example, the castor bean. These extracts agglutinated bloods of a wide variety of species. Later, Landsteiner showed that some extracts exerted a more powerful action on the erythrocytes of some animal species than on those of others. A degree of species specificity was thus demonstrated. During World War II the present author and, independently, Renkonen demonstrated that extracts of certain seeds, especially certain beans, showed a specificity even within a single species. For example, extracts of certain varieties of Lima beans agglutinated only blood cells of groups A and AB, being thus specific for the blood group A antigen; others agglutinated group B also. Some agglutinated none of the four blood groups. Extracts of another species, the scarlet runner bean, agglutinated bloods of all four groups. Some extracts allowed the subgroups of A and AB to be noted, others did not. It is evident that theoretical importance attaches to a study of the chemical nature of these plant agglutinins, to methods of preparing them, and to the question of their mode of inheritance in the plants. Also, if a specific plant B agglutinin, for example, could be found, or separated from an AB agglutinin by genetic methods, or possibly even if this could not be done (since in the USA anti-A is the scarce agglutinin in the population), these reagents might have practical importance, especially as they are very cheap to prepare.

An Analysis of the Responses of Plants to the Length of Day

James Bonner, *California Institute of Technology*

Growth and development among many species of plants are directly influenced and in fact controlled by the relative lengths of day and night—a phenomenon known as photoperiodism. Although the responses of plants to this environmental factor of photoperiod include its effects upon vegetative growth, a still more spectacular response and one that has undergone more investigation is that of the initiation of the flowering condition. Thus, in one category of plants, that of the short-day plants, the flowering condition is initiated only when the plant is grown on a regime in which the nights exceed a particular critical length in their duration. Flowering in these plants is then a response to the length of the dark period. Under certain circumstances, however, interruption of the dark period by a single light flash may result in total suppression of flowering.

Much has been learned in the past about the kinetics of the photoperiodic process as well as of the anatomical changes which accompany floral differentiation, but it has only been recently that any description of the physiology of the photoperiodic process or attempt to separate the over-all process into its constituent partial processes has been possible. In short-day plants, the initiation of floral primordia is mediated by the leaves, the organs directly sensitive to photoperiod. Under the influence of a long dark period or repeated dark periods, the leaves produce and export to the buds a substance or substances which cause flower bud initiation. Although the dark process is inhibited by an interruption with even the minutest quantities of light, nonetheless the dark period, to be an effective one, must be preceded by a light period of suitable duration and of relatively high intensity. These processes may be summarized as follows:



Present experimental evidence indicates that Process 1 may be that of photosynthesis, since the requirement may be met by supplying the plant with sucrose. Process 2, the dark process, appears to bear a relation to the metabolism of auxin, the plant growth hormone, in the leaf. Thus, this process is suppressed by the artificial application of auxin to the leaf. The flowering substance itself (or substances themselves) is of an unknown nature and can be at present described only in terms of its movement within the plant and from plant to plant.

Variability in Menstrual Cycles

George W. Bartelmez, *Carnegie Institution of Washington*

The tradition of a 28-day menstrual cycle still persists, although the normal range is from 3 to 5 weeks in the human species and also in the rhesus monkey. Cycles of the same length may differ radically from one another. Variability is inevitable in a cycle controlled by a system of balanced endocrine forces, since a fluctuation in any one changes the configuration of the whole. Such changes tend to modify the time relations of the component "phases" of the cycle, as well as its total length. The ultimate receptors (target organs) reflect changes in hormonal balance. The varying concentration of hormones in consecutive cycles is manifest especially in the graded series of responses of the Hartman staircase. In addition the susceptibilities of a target organ may vary. Thus the threshold for response in the uterine mucous membrane differs in various areas of the same organ, as well as in different individuals. Conditions in preceding cycles may also influence the appearance of a target organ.

Adequately documented and normal human material is extremely rare. In a series of 197 selected specimens from rhesus monkeys the uterine mucosae have been grouped primarily on the basis of the controlling ovarian conditions. These groups are not homogeneous. There are differences in the reaction of the several tissues of the mucous membrane; the gland cells may show the characters dominant in one group, whereas the intervening connective tissue resembles that of another group. There is a definite rhythm in female primates. It is not a rhythm of gears and levers, but that of a living, pulsating organism attuned to various influences, both internal and external.

Differential Growth Response of Nerve Cells to Thyroid Hormone

Paul Weiss and Fiammetta Rossetti, *University of Chicago*

The physiological basis of the differential activation of specific patterns of nerve cells by hormones (e.g., in sex behavior), is still obscure. Evidently, certain neuron combinations are singled out to the exclusion of others, which could be due either to differential accessibility of the hormone or to specific constitutional response differences among various kinds of neurons. The following experiments strongly support the latter alternative. They deal with the transformation of the larval into the metamorphosed brain in the frog under the action of the metamorphosing hormone of the thyroid.

A pair of large cells in the larval hindbrain (Mauthner's cells), concerned with swimming, disappear after metamorphosis from amidst a group of persisting neurons. This regression is not caused by peripheral changes (loss of tail), since mere tail amputation or high transection of the spinal cord fails to evoke it. Presumably the cell bodies react directly to the metamorphosing hormone. To test this assumption, fragments of rat thyroid or thyroxin-agar were implanted near the hindbrain of immature tadpoles according to Kollros. Within a few days, marked local changes developed in the adjacent hindbrain. Mitoses in the ependyma increased by more than 500%. This stimulation extended far into the spinal cord. The cells and nuclei of the gray matter gained in size, the nuclear volume increasing to an average of 182% with fresh gland, and 165% with thyroxin. In sharp contrast to this growth stimulation, Mauthner's cells, interspersed with the stimulated cells, atrophied, losing *ca.* 30% of their cytoplasmic volume and 20% of nuclear volume. Mauthner's cells thus reacted in a sense opposite to that of other nerve cells at the same level. The reactions reached a peak about the third day after implantation, then subsided with the disintegration and hormone depletion of the grafts. No similar effects were observed in control experiments with fresh parotid glands or boiled thyroids as grafts.

The experiments thus prove that thyroid hormone affects the growth of nerve cells directly, but acts differentially and even antagonistically on different types of neurons, revealing thus a preformation of the response pattern in latent constitutional differences among the different units of the neuronal population.

Quantitative Cell Morphology

Paul Weiss and Beatrice Garber, *University of Chicago*

Cell forms are still largely described pictorially, e.g., as spindle-shaped, arborized, disc-shaped, crenated, etc. Physiological and pathological cell transformations are dealt with in similar terms. The present paper reports a first attempt to reduce such static descriptions to objective, quantitative, and relatively precise terms with reference to the formative and transformative processes.

A general dependence of the morphology and motility of chick mesenchyme cells in tissue culture upon the physical constitution of the culture medium (blood plasma) had previously been established (Weiss 1929). On the assumption that the deviation of a free cell from spherical shape depends on (*a*) adhesion and extension of surface protoplasm along fibrous strands in the medium, (*b*) hydrodynamic competition for further protoplasmic inflow among these protrusions, (*c*) cohesive and elastic properties of the cell, and (*d*) rate of protoplasmic motion, it can be predicted that the shape of a cell (e.g., number of poles), the ratio of length to width, the proportions of the nucleus, the rate of migration, and related features will be direct functions of the texture of the medium (density of fibrous strands and frequency of intersections). Experiments were therefore set up in which the texture of the blood plasma clot was methodically varied by varying either plasma concentration over a range from 10 to 90% or pH from 5.6 to 8.0, with other conditions being kept constant.

Measurements on 3,764 cells from standard fibrocyte cultures plotted against concentration or pH gave smooth curves of the predicted trend. With increasing concentration or decreasing pH (increasing coarseness of the fibrin net), the number of cell processes decreased (the ratio of bipolar "spindle" cells to multipolar "stellate" cells increased), and the ratio of length over width for both cell body and nucleus increased. Rate of movement increased at first, but tended to become constant above the 50% concentration. The results indicate that an objective quantitative cell morphology is feasible and conducive to better understanding of cell morphogenesis.

Migratory Behavior of Embryonic Pigment Cells Isolated Singly or in Small Groups *in Vitro*

Victor C. Twitty, *Stanford University*

The cells responsible for the pigmentation of the vertebrate skin and its derivative structures originate from the "neural crest" of the embryonic spinal cord and attain their eventual widespread distribution in the body by ameboid migration from this source. Earlier studies by the author on the migratory behavior of populations of embryonic pigment cells *in vitro* strongly indicate that their dispersion from the neural crest is a response to chemical excitation exerted mutually by the developing pigment cells. This interpretation is substantiated by the present study, in which neural crest cells were isolated singly or in small groups of two or more in capillary tubes of very small bore. Single cells, although surviving and differentiating normally, remain essentially stationary, whereas cells isolated in pairs or in small groups move away from one another, often for considerable distances, and tend to assume a uniform spacing within the tube. The results establish definitely that these movements are in response to mutual stimulation, and the strongly directional character of the migrations points clearly to diffusion gradients as the motivating factors.

Resumption of Ovulation by Mouse Ovaries Following Implantation in the Spleen

C. C. Little, *Jackson Memorial Laboratory*

The work of Biskind and Biskind with rats and of Gardner and Li with mice showed that the ovary, when removed from its normal site and transplanted in the spleen of a gonadectomized animal, became malignant after a prolonged sojourn.

The present series of experiments repeats the basic technique of Gardner and Li. It uses inbred strains of mice. It adds to the former technique the removal of the transplanted ovary from its splenic site and its retransplantation in the ovarian capsule of gonadectomized females. The genetic theory of transplantation is used to

select animals for retransplant hosts in such a way as to give optimum conditions for successful growth.

The objects of the experiment are as follows:

(1) To determine whether retransplantation is successful and will be followed by resumption of normal ovulatory function.

(2) To determine the maximum duration of splenic sojourn after which such retransplantation can be followed by ovulatory function.

(3) To determine whether individual or genetic modifications occur in the progeny from retransplanted ovaries.

(4) To establish the length of splenic sojourn necessary before an irreversible change toward carcinogenic potentiality occurs in the ovary.

At present clear evidence has been obtained bearing on objectives (1) and (2).

Ovulatory function has been resumed by retransplanted ovaries, and viable young have been obtained from ova liberated after 14, 28, 35, 42, and 60 days' sojourn of the ovary in the spleen.

Successful ovulatory function of retransplanted ova appears, however, to decrease progressively as the length of the splenic sojourn increases.

The successful resumption of the ovulatory function and the survival of fertile progeny make it possible to attack the third and fourth objectives.

In addition to providing an opportunity to study the relationship of mutation to carcinogenesis, and the time and nature of the carcinogenic changes in the splenic transplants of the ovary, the existence of at least 9 strain differences in the structure and function of the ovary can be investigated under parallel environmental stress of the splenic environment.

Mechanism of Coagulation of Plasma Albumin by Urea

Charles Huggins and Elwood V. Jensen
University of Chicago

Although urea dissolves certain types of protein gels, it induces gels in concentrated solutions of other proteins such as albumin (Ramsden, 1902). The presence of sulfhydryl groups is essential to this urea-induced coagulation of plasma albumin. The addition to urea of small amounts (1 equiv/mole albumin) of all classes of reagents which destroy –SH prevents the formation of these gels of albumin. Also, preliminary treatment of the albumin to eliminate its sulfhydryl group, with subsequent removal of the sulfhydryl reagent, renders the protein incoagulable in urea; the addition of minute amounts of –SH restores the capacity of the protein to gel.

It appears that urea disrupts the structure of certain proteins such as plasma albumin, making disulfide groups reactive to small concentrations of sulfhydryl. By means of a chain reaction between protein-sulfhydryl and protein-disulfide groups a reticulum is knitted together, consisting of intermolecular protein-disulfide bonds which hold together the extended protein chains. The liquid phase is bound to the protein within this framework, and clear firm gels result.

Evidence for the Occurrence of True Mitosis in Bacteria

Edward D. DeLamater, *University of Pennsylvania*

Previous methods, utilizing the electron microscope, quartz optics and ultraviolet light, and routine light microscopy, have demonstrated the presence of probable nuclear structures in bacteria and the fact that these bodies reduplicate themselves. Intrinsic structure and the mechanisms of division have, however, remained obscure. With the development of new methods which utilize an essentially new approach to the dehydration of tissues and cells, details of nuclear structure and divisional mechanisms have become visualizable. The method takes advantage of the fact that it is possible to remove water from tissues in the frozen state at very low temperatures (–50° C) by the use of chemical dehydrating agents, such as alcohol, acetone, and ethylene glycol, which remain liquid at these low temperatures. No vaporization of the water from the frozen state in a vacuum is necessary. The use of alcohol or acetone adds the further desirable advantage of leaching out fatty substances in the cell which tend to obscure detail. This solvent also hardens the fabric of the cell as dehydration proceeds. Instantaneous freezing prevents initial distortion of the intrinsic structure.

By means of this new procedure clear-cut evidence for the occurrence of a typical mitotic process in several representative forms of bacteria has been demonstrated. Members of the genera *Bacillus*, *Escherichia*, *Micrococcus*, and *Caryophanon* have been studied.

The mitotic cycle undergoes recognizable prophase, metaphase, anaphase, and interphase stages. Polar bodies, or centrioles, appear at prophase, separate to the poles at metaphase, and persist into telephase. At interphase the chromosomes elongate into long, delicate, beaded threads.

Observations on Developing Bacteriophage

Ralph W. G. Wyckoff, *National Institutes of Health*

Electron micrographs of *E. coli* diseased with bacteriophage have shown objects that may be incompletely developed particles of the viral agent. For an understanding of the way bacteriophage grows, it is important to see these objects as clearly as possible in relation to the bacteria in which they form. Comparative preparations using a single broth culture of infected bacteria have therefore been made in ways designed to clarify these relationships. These preparations have been (1) pseudoreplicas of the total content of the culture, (2) deposits of the infected organisms dried from water and from a liquid of low surface tension, and (3) sections through the organisms to reveal their contents. Electron micrographs demonstrate the influence of these methods of treatment on the appearance of the infected cells. They give new information about changes that occur after adsorption of the infecting bacteriophage, they show bacteriophage developing within the bacteria before lysis, and its escape afterwards. They also demonstrate how the observed mechanisms of lysis account for the different phenomena produced by fast and slowly lysing strains. Extension of these observations should add much to our mounting knowledge of the way bacteriophage destroys susceptible bacteria and multiplies at their expense.

The Influence of Intracellular Electrolytes upon Tissue Protein Repletion

Paul R. Cannon, Laurence E. Frazier, and Randolph H. Hughes, *University of Chicago*

The influence of potassium, phosphorus, and magnesium deficiency upon the processes of growth suggests their

probable importance, also, in relation to tissue protein repletion. This latter problem has been investigated by us in protein-depleted adult rats.

Because during protein depletion much of the lost tissue nitrogen comes from muscle, there is also a concomitant loss of intracellular ions, viz., potassium, phosphate, and magnesium. When protein-depleted animals are fed a repletion ration which supplies all dietary constituents essential for effective tissue protein repletion, except for the absence of one or more of these electrolytes, the processes of tissue repletion are markedly impaired. For example, when potassium is omitted from the diet the animals lose appetite, fail to regain weight rapidly, and develop severe myocardial "necroses" within 6 days. Within 2–3 weeks many of them die of congestive heart failure. The addition of potassium chloride to the diet causes a resumption of the usual course of tissue protein repletion and a resolution of the myocardial lesions. The dietary omission of phosphate leads, also, to a marked interference with tissue repletion; and omission of both potassium and phosphate induces a slower rate of repletion than does omission of either electrolyte alone.

These observations reemphasize the probable importance of intracellular electrolytes in relation to total parenteral alimentation and suggest a need for better balanced electrolytic solutions in order to supply those intracellular ions presumably necessary during the period of reconstruction of intracellular protoplasm.

The Antrum of the Stomach; an Endocrine Organ Concerned with Gastric Secretion

Lester R. Dragstedt, ***University of Chicago***

It is well known that the presence of food in the stomach excites the secretion of gastric juice by the glands in the mucous membrane. This stimulation can occur even after the vagus nerves, which contain secretory fibers to the gastric glands, have been divided. It has been attributed to the formation of a hormone or chemical excitant to gastric secretion in the mucous membrane of the stomach or upper intestine on contact with food. In a further study of this problem in dogs provided with isolated stomach pouches of various types, my associates and I have found that removal of the antrum, or lower portion of the stomach, causes a profound reduction in gastric secretion. Removal of one half, or even two thirds, of the antrum may have no effect, but when the remaining remnant is removed, the full effect is seen. Transplantation of the antrum of the stomach to the abdominal wall so that it does not come in contact with food causes the same decrease in gastric secretion obtained when the antrum is removed. Subsequent transplantation of the antrum into the duodenum as a diverticulum restores the gastric secretion to its normal value. Transplantation of the antrum to the colon as a diverticulum so that it comes in contact with fecal material causes an excessive secretion of gastric juice in the stomach with the regular formation of peptic ulcers. Transplantation of the middle or upper part of the stomach into the duodenum or colon has no stimulating effect on gastric secretion. It is concluded that the mucous membrane of the antrum of the stomach is a specific internal secreting organ concerned with the elaboration of a chemical substance that stimulates the secretion of gastric juice on contact with food. An excessive activity of the antrum is produced when it is transplanted into the colon, and this excessive activity results in the formation of experimental ulcers.

A Factorial Study of the Supreme Court

L. L. Thurstone and James W. Degan
University of Chicago

The object of the present study is to ascertain by factorial methods whether the voting records of the individual judges give evidence of any groupings in the Supreme Court. This paper is an exploration in scientific method on the problem of identifying the blocs or subgroups within a larger group, as in a legislature, council, or court, in terms of the voting records of the members. The present study was made on the voting records of the Supreme Court judges during the terms 1943–44 and 1944–45 on 115 cases in which there were at least two dissenting votes. A correlation coefficient was computed for each pair of judges. These coefficients indicate the extent of agreement or disagreement among the judges. The coefficients were assembled in a square table of order 9×9, which is called a correlation matrix.

The correlation matrix was factored by the complete centroid method. Three common factors were sufficient to account for the observed correlations. A three-dimensional model can be made to represent the correlations. Each judge is represented by a vector, and each correlation by the scalar product of two vectors.

The multiple-factor methods seem to be promising for analyzing loyalties and identifications by the voting records of the members of a group.

Direct Currents of the Brain

Wolfgang Köhler, ***Swarthmore College***

The recording of direct currents from the heads of human subjects (*Science*, **110**, 414 [1949]) has been continued in collaboration with R. Held and D. O'Connell. It has been confirmed that, when objects move across the visual field, currents spread in the visual cortex, and that the behavior of these currents agrees with known facts of brain localization. More recent records have shown that dark objects which move on a bright ground also establish currents. Currents of stationary objects have been found to be less intense than those of moving objects, presumably because the former cause stronger electrotonic obstruction. Accordingly, the current of a moving object is abruptly weakened when the movement is suddenly interrupted. The investigation of cortical currents can probably not be separated from the study of their electrotonic action.

When the position of the "active" electrode corresponds to the region of the auditory cortex, a steady flow is registered during stimulation of the ear. Experiments in which the active electrode is placed on the exposed auditory cortex of animals have just begun. Results agree with findings obtained from the intact heads of human subjects. The electrotonic obstruction caused by currents in this area seems to be weaker than that caused by visual currents.

Both visual and auditory currents are generally followed by afterpotentials which have the same polarity as the original currents. Under the influence of many exposures these afterpotentials tend to grow, and then to be spontaneously repeated as long sequences of slow waves.

The Mass Spectrometer as a Research Tool

Alfred O. C. Nier, ***University of Minnesota***

During recent years the mass spectrometer has been

developed to be a useful research tool in many fields. The isotopic composition of almost all elements is now well known. Stable isotopes have become valuable as tracers in biological and geochemical investigations. Electron impact studies of molecular gases have led to useful data on molecular structure. As analytical tools, mass spectrometers have proved their worth for making chemical analyses and for hunting leaks in vessels. Continuous recording instruments have been employed in making continuous analyses of gas streams. Use of such instruments has been made in industry and in medicine.

A summary of recent work in mass spectrometry illustrated by examples of current applications is given.

Quantum Dynamics

Julian Schwinger, ***Harvard University***

The conventional quantum mechanics of particles and fields consists of a set of correspondence rules which are superimposed on the classical mechanics of a given dynamical system. It is our purpose to provide a self-contained basis for quantum dynamics by means of a single fundamental principle, from which operator equations of motion and commutation relations can be obtained. The principle is stated as a variational equation for the transformation function connecting eigenvectors of complete sets of physical quantities at different times, for nonrelativistic particle dynamics, and on different spacelike surfaces, for relativistic field dynamics. Generating the infinitesimal change of the transformation function is the variation of an operator which is called the action integral, according to its classical analogue. We deduce an operator principle of stationary action, which yields the equations of motion for specific dynamical systems. The boundary terms in the action principle provide infinitesimal generating operators which imply the commutation relations of the system. An invariant field action integral guarantees that the structure of the dynamical principle is unaltered by relativistic coordinate transformations, with the exception of time reflection, where a separate discussion is required. It is shown that the latter cannot be included within the unitary transformation framework of quantum mechanics, but requires the transposition of all operators for its representation. The requirement of time reflection invariance then restricts the operator properties of a field in a manner which is simply the connection between the spin and statistics of elementary particles.

High Resolution of the Near Infrared Spectra of Simple Polyatomic Molecules

Earle K. Plyler, ***National Bureau of Standards***

With the availability of photoconducting cells it has been possible to increase the resolving power of grating instruments in the near infrared region by a factor of five. By using the highest grade optics for the mirrors and the grating it is possible to use 0.02-mm slits. With such slits lines can be resolved which are separated 0.12 cm^{-1} at 2 μ.

The spectra of many molecules have been measured in the region from 1.2 to 2.8 μ.

The rotational vibration bands have been measured by placing on the recorder trace the emission lines of different gases such as krypton and argon. By having a large number of comparison wavelengths the positions of the rotational lines can be determined to ± 0.03 cm^{-1}. Two bands of C_2D_2 at 1.96 and 2.39 μ have been measured, and the rotational constants determined. It is possible to determine the ground state rotational constant (B_0) to the fourth decimal place by accurate measurement of these two bands.

Sixteen bands of C_2H_2 have been measured from 1.6 to 2.6 μ. The combination bands indicate that one of the stretching vibrations of CH (ω_3) should be assigned a value of 3,075 cm^{-1} instead of the present assignment of 3,273 cm^{-1}. The rotational structure has a coarse spacing of about 8.1 cm^{-1} and fine spacing of 1.8 cm^{-1}. In addition many small lines are observed in the spectra which have not been previously resolved. These extra lines are produced by interaction of the higher states.

Theory of Molecular Complexes

R. S. Mulliken, ***University of Chicago***

Generalization of previous ideas gives a simple quantum-mechanical theory of molecular complexes. Let A be an electron acceptor and B a base (electron donor). Typically, A may be a neutral molecule or a positive atom-ion, B a neutral molecule or negative atom-ion. For example, A may be I_2 or Ag^+, B may be benzene or I^-.

Most often, A and B have even-electron diamagnetic structures. Then A and B, and therefore the complex $A \cdot B$ have totally symmetrical singlet wave functions. These can be written as

$$\psi = a\psi_0 + b\psi_1 + \cdots\cdots\cdots\cdots . \qquad (1)$$

Here ψ_0 is usually a *no-bond* function $\psi(A, B)$ and ψ_1 a *dative* function $\psi(A^-—B^+)$ with covalent bond between A^- and B^+ (weak in loose complexes, strong in molecules such as $R_3N \cdot BX_3$). Eq. (1) also fits simple molecules like HCl or NaCl taking A as H^+ or Na^+ and B as Cl^-; but now ψ_0 involves ionic bonding, and ψ_1 only covalent bonding (A^- and B^+ are atoms).

Eq. (1) involves resonance energy of approximate amount

$$RE \approx W_{01}^2/(W_1 - W_0). \qquad (3)$$

Here W_0, W_1 are the energies of pure ψ_0, ψ_1; W_{01} is a matrix element.

The *"charge-transfer forces"* corresponding to Eq. (3), although more specific and valencelike, to some extent resemble London's dispersion forces, and apparently must share with the latter in accounting for van der Waals attractions. Charge-transfer forces, however, should have strong orientational properties, of probable importance in determining how molecules pack in crystals or liquids. This is because resonance requires that ψ_1 and ψ_0 have the same group-theoretical symmetry. Thus in $Ag^+ \cdot$ benzene, $\psi_1(Ag—Bz^+)$ violates this requirement if the silver atom is either on the benzene sixfold axis or in the ring plane.[1] An intermediate location is thus indicated. This prediction is supported by experimental evidence.

[1] This is because the Bz^+ wave function has nodal planes through both locations, whereas the Ag function has none.

The Oxidation-Reduction Theory of Latent Image Formation

W. G. Lowe, ***Eastman Kodak Company***

Current theories consider latent image formation in the photographic emulsion to be a reduction process involving

electron capture at trapping sites. Gurney and Mott assume the presence of chemical impurities. Mitchell suggests a physical trap (positive Schottky defect) but requires mobility of the positive defect for latent image formation.

Recent results show that the unsensitized emulsion possesses sensitivity due to the presence of unoxidizable, "primitive" traps, whereas the effects of chemical sensitizing can be quantitatively destroyed by oxidation. Controlled reduction of the emulsion gives reduction sensitizing, which is chemically distinct from any stable stage of latent image formation. The action of certain oxidizers on the reduction-sensitized emulsion gives results (latent image formation, latensification) similar to the action of low-intensity light on the primitive emulsion.

It is suggested that the primitive traps in the silver halide grain are "frozen-in" groups of Schottky defects at free and internal surfaces, stabilized at the free surfaces by adsorbed colloid. In this model latent image formation is an oxidation-reduction reaction in its first stage, involving trapping of electrons and positive holes at the primitive trap. In its second stage it follows the Gurney-Mott mechanism, the latent image acting as a deep chemical trap. In terms of this model it is possible to describe reduction sensitizing, the unstable subimage, the first stable subimage, the latent image, selective desensitizing, latensification by oxidizers, and the mechanism of print-out.

Schizoid Behavior of Liquids

Kenneth C. D. Hickman, ***Eastman Kodak Company***

Experiments are showing that liquids tend to develop a surface film that hinders evaporation. The film is probably due to traces of soluble impurity which become preferentially located in the surface of any undisturbed liquid. The effect is noticeable chiefly under high-vacuum distillation, when the surface may separate abruptly into two areas, a smooth "torpid" section and a violently agitated "active" section. Certain mixed liquids present an entirely torpid surface, some chemically pure liquids an all-active surface, but the usual condition is "schizoid," with both surfaces present and separated by a steep barrier. The active area is depressed below the torpid by a depth equal to the difference of recoil from their projective vapors. Both the accommodation coefficient and relative volatilities (from mixtures) are low for the torpid area, high for the active. The effect is best seen between 10 μ and 10 mm absolute pressure and has been observed on most of the liquids so far examined, for instance on silicones at 220° C, di-octyl phthalate at 150° C, *n*-octamol at 0° C, *n*-butanol at –30° C, ethanol at –45° C, and propane at –150° C. Torpidity appears to be a fundamental condition of surfaces; the experimental examination of the effect is not difficult.

The Mechanism of Optical Sensitization

B. H. Carroll and W. West, ***Eastman Kodak Company***

Optical sensitization of photographic emulsions by adsorbed dyes involves an interaction between dye and silver halide producing latent image through the absorption of less energy than is required by the silver halide alone. The energetics of the process is still problematical, but recent studies have widened our knowledge of sensitization as influenced by the state of the dye. In effect, the optically excited dye transfers energy to the silver salt, generating a quasi-free electron which initiates latent image formation. At low concentrations, individual dye molecules adsorbed at random over the grain surface may be highly efficient in this process. At higher concentrations the adsorbed dye assumes a new cooperative state, characterized by strong lateral interactions between dye molecules, and often by new absorption bands, displaced from the molecular bands. In the cooperative state energy absorbed by any one molecule flows rapidly throughout the whole layer, the short interaction time at any surface site causing inefficiency in sensitization. The efficiency of the cooperative layer can, however, be increased by small additions of foreign substances. These *supersensitizers* appear to form perturbed sites in the layer at which energy propagation is retarded, with consequent increase in the probability of transfer to the silver halide. The inverse phenomenon also exists, in which perturbing molecules, *antisensitizers*, by accepting and degrading the excitation energy of the sensitizer, strongly inhibit transfer to the grain. Super- and antisensitizers influence photoconductivity parallel to photographic sensitivity, showing their direct participation in primary sensitization.

The Diffusion Coefficients of Electrolytes in Dilute Aqueous Solutions

Herbert S. Harned, ***Yale University***

By employing electrical conductance as a measure of concentration, a method has been developed for the determination of the differential diffusion coefficients of electrolytes. Measurements at concentrations between 0.0005 and 0.5 *N* show that the accuracy of the evaluation of the diffusion coefficient is of the order of 0.1%. Indeed, with potassium chloride at 0.2–0.5 *N*, values obtained by the conductance method and the recently developed Gouy interference fringe method agree within 0.05%.

The most valuable feature of the method resides in the fact that, for the first time, results of sufficient accuracy are available for testing the accuracy of the limiting equation of Nernst, and the theory of Onsager and Fuoss for the variation of diffusion coefficients of electrolytes with their concentrations in dilute solutions.

The results for 14 electrolytes of various valence types lead to the following conclusions: (1) The Nernst limiting equation is valid. (2) In all cases, the results approach the values predicted by the limiting law of Onsager and Fuoss as the concentrations of the electrolytes approach zero. (3) Remarkable agreement with theory in dilute solutions is observed for a few electrolytes. (4) Departures from the theoretical predictions sometimes occur.

Electromotive Force from Proton Exchange Reactions

Theodore Shedlovsky
Rockefeller Institute for Medical Research

Electrochemical cells derive energy from oxidation-reduction, i.e., electron exchange reactions which occur at the electrodes, anode and cathode, when electron transport is available at these sites through metallic conduction.

Similarly, acid-base—i.e., proton exchange reactions—may be expected to yield electrical energy if proton transport is available at the sites—i.e., "protodes" at which protons are exchanged.

Proton conduction exists in acids and also in water. The familiar glass "electrode" is a hydrogen ion protode at which the reaction H_3O^+ (hydrogen ion) = $H_2O + H^+$ (proton) takes place.

An insoluble acid H^+A^- and its insoluble salt, M^+A^-, may be expected to behave as an M^+ ion protode through the reaction $M^+A^- + H^+$ (proton) = $H^+A^- + M^+$ just as the silver–silver chloride electrode behaves as a Cl^- ion electrode through the reaction $Ag^+Cl^- + \epsilon^-$ (electron) = $Ag^+\epsilon^-$ (silver) + Cl^-, with the difference that a proton is involved in one case and an electron in the other.

To test these ideas, a study was made of cells containing a glass (hydrogen ion) protode and a laurie acid–barium laurate (barium ion) protode in buffered barium chloride solutions of various compositions. The potentials of these cells varied linearly with the logarithm of the activity of the barium ion constituent and with the pH in accordance with theory.

Since metallic conductors are not present in living cells, oxidation-reduction reactions cannot be the immediate energy precursors for bioelectric phenomena; proton exchange reactions may, however, play an important part.

Configurational Standards and Configurational Relationships in Organic Compounds

M. L. Wolfrom, *Ohio State University*

Considerable confusion exists among chemists regarding configurational standards and configurational relationships. A group of substances containing asymmetric centers can be related to each other through the selection of a suitable reference standard. Such a standard must contain only one asymmetric center whose orientation is assumed. To arrive at a rational system of relationships it is then necessary to establish a series of groups arranged in an order which will give precedence to the groups to be selected for the top and bottom of the tetrahedral orientation. When more than one asymmetric center is present in a compound, each center may be considered to be related to the reference standard to give a composite picture. It is convenient, however, to select one center as a reference for the entire compound or series of centers. This is best done by selecting the center at one or the other end of the sequence. This involves again an orientation as to which end shall take precedence. The same reference series could likewise be used to decide this issue.

Separation and Characterization of High Molecular Weight Polypeptides

Lyman C. Craig and Alan R. Battersby
Rockefeller Institute for Medical Research

Attempts to develop adequate methods for the separation and characterization of polypeptides have led to the construction of automatic discontinuous countercurrent extraction equipment containing 220 equilibrium cells in a single train. This, together with the discovery of suitable liquid-liquid systems, permits clear-cut separation of the naturally occurring peptides.

In this work it has been noted that any change involving an acidic or basic group has a striking effect on the partition ratio of the peptide in a given system. An approach to the problem of molecular weight determination is thereby suggested.

Analysis for a given substituent permits calculation of a molecular weight if the number of such substituents can be determined. A countercurrent distribution pattern obtained after partially transforming the peptide with a suitable reagent (fluorodinitrobenzene, esterification, etc.) permits the number of such groups to be derived.

In the case where the DNP reagent is used, the appearance of two well-separated bands, one the unreacted peptide and the other a yellow band of the derivative, will indicate the presence of a single amino group in the molecule. The appearance of a second yellow band indicates two amino groups, etc.

On the Existence of a Basis for Every Finite Abelian Group

Jesse Douglas, *Brooklyn, New York*

Every element Θ of a finite commutative group G can be expressed uniquely as a product of powers of a chosen set of elements $a, b, \ldots, c$ of G: $\Theta = a^\alpha b^\beta \ldots c^\gamma$. The proofs of the existence of this *basis* for G given in the standard treatises are usually fairly complicated, involving an inductive procedure. The present paper gives a simple constructive type of proof patterned after the elementary one for a basis of a vector space—the fundamental idea of which is the striking out of vectors that are linear combinations of other vectors yet remaining unstricken.

This idea, however, does *not* permit of *immediate* transfer to Abelian groups—if we remove systematically elements that are power products of other elements yet remaining, we shall generally *not* be left with a basis.

Supposing G to be of prime-power order, the point is first to *arrange* the elements of G in *nonascending* order of their *periods*, then moving through the elements of G in this order, to strike out each element expressible as a power product of elements as yet unstricken. The elements remaining at the end of the process are a basis.

If the order of G is $g = p^\alpha q^\beta \ldots r^\lambda$, where $p, q, \ldots, r$ are different primes, then G is the direct product of Abelian groups of the respective orders $p^\alpha, q^\beta, \ldots, r^\lambda$, so that the general case is reduced to that of prime-power order.

Capella, the Anchor of Eddington's Mass-Luminosity Relation

Otto Struve, *University of California, Berkeley*

Capella, or Alpha Aurigae, is the second brightest star in the northern sky. A giant pair of suns, of approximately the solar temperature but almost ten times larger than the sun in size, revolve around one another in a period of 104 days. At Mount Wilson, Anderson and Merrill have resolved the pair with a large interferometer. This circumstance makes it possible to determine the masses of the component stars designated by the letters G and F. About 30 years ago A. S. Eddington recognized that the masses of these solar type stars are about four times greater than the mass of the sun, and their luminosities about 100 times greater. This led him to suspect that the energy production in a star depends almost entirely upon its mass: the cosmic nuclear energy machine works more efficiently for large masses than for small! (In fact, Eddington attached his famous mass-luminosity relation to the observed parameters of Capella at one end and the sun at the other. In one way or another this unusual

significance of Capella has influenced all more recent astrophysical discussions of the production of energy in stellar interiors.)

Recent observations of the spectrum of Capella with high dispersion, at Mount Wilson, show that the F star is peculiar. Ordinarily, the observed absorption spectrum consists of a jumble of thousands of lines, some belonging to the G star, others to the F star. It is like a coded message requiring a key for its decoding. In our case there are two such keys—a normal G-type spectrum (sun or Arcturus) and a normal F-type spectrum (Procyon or Alpha Persei). The former immediately disentangles the G-type lines—there is nothing strange about it. But the latter fails completely. The F spectrum of Capella is unlike that of any other star that I have encountered. Its strong lines are enormously enhanced and broadened, and its weaker lines are completely blocked out. The former measurements of the velocity of the F star are therefore little more than guesses, and hence the resulting masses of both components are uncertain. We have here a fascinating puzzle: first, we must explain the peculiar aspect of the F spectrum; second, we must measure its velocity and thus provide a reliable anchor for the mass-luminosity relation; and, third, we must recognize the growing amount of evidence that *close* binaries are not like single stars. The components disturb one another, and render them "peculiar." Since we use the law of gravity to determine the masses of the stars, and binaries are the only astronomical objects that furnish us with a measure of their gravitational accelerations, it will be advisable to use wide, visual pairs, whenever possible, to study problems of energy generation.

Evolution of the Protoplanets

Gerard P. Kuiper, *Yerkes Observatory*

The protoplanets developed from the solar nebula as extensive flat gaseous disks rotating in the tidal field of the sun. It is shown that such masses will contract. This increases the angular velocity of rotation until the outer fringes move in nearly free circular orbits. The conditions of ejection from the periphery are developed. It is found that turbulence may attain a velocity dispersion around the circular motion of rotation large enough to cause ejection of part of the gaseous matter. This would lead to a nearly constant total energy content throughout the history of the protoplanets, but a steadily diminishing angular momentum per unit mass.

A more detailed examination of the stability conditions of disklike protoplanets has led to a roughly fivefold increase of the masses found in the first approximation. With these improved masses, the initial (negative) energy content of the protoplanets is computed and compared to the present energy contents. The accord is fair for the Jovian planets, showing here that the hypothesis of ejection produced by internal turbulence alone is fairly adequate. However, for the terrestrial planets, the present energy content is larger, algebraically, than the initial one, proving that the sun supplied energy during the ejection process (as in fact, the sun still does today in the atmospheric ejection of H_2 and He).

The history of the angular momentum content of the protoplanets is nearly, but not entirely, accounted for by the same process of equatorial instability and superimposed solar tidal friction.

There are two stages in the ejection process: Stage A in which the density of interplanetary matter was above 10^{-17} and true evaporation was impossible; the ejection was by eddy escape (hydrodynamic flow), and no fractionation by molecular weight took place. This stage was followed by Stage B, during which true evaporation occurred; it did not begin until Stage A had run its course and the density of interplanetary matter, by turbulent dissipation, had fallen below 10^{-17}. Condensation and sedimentation in this evolution are discussed.

Multiply-recurrent Geomagnetic Activity

Oliver R. Wulf and Seth B. Nicholson
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There is a well-known tendency for geomagnetic disturbance to recur after an interval of about 27 days. In certain instances, where such geomagnetic activity was multiply recurrent, an area of bright chromospheric clouds was observed to come around the east limb of the sun, because of solar rotation, at about the time of onset of disturbance. If such areas emit more ultraviolet radiation than an equal area of the undisturbed sun, it appears possible that they may be instrumental in causing irregular air motions in the ionosphere producing geomagnetic disturbance by dynamo action. An extension of this picture suggests a plausible description of the tendency for magnetic bay disturbances to recur at intervals of approximately 24 hr.

Origin of Lake Ilopango, El Salvador

Howel Williams, *University of California*

An east-west structural trough cuts athwart El Salvador and continues through the Gulf of Fonseca and Lakes Managua and Nicaragua to the border of Costa Rica. In El Salvador, this trough represents the downfaulted crest of a geanticline formed in Late Pliocene or Early Pleistocene time. It was then that the original basin of Ilopango was formed.

Subsequently, a chain of imposing Pleistocene and Recent volcanoes was built within and close to the margins of the trough. Filling of the original Ilopango basin began by protrusion of dacite domes through its sides and by accumulation of fluviatile pumice deposits produced by reworking of ejecta discharged partly from the domes just mentioned and partly from the volcano of San Salvador to the west. Later, colossal glowing avalanches of dacite pumice issued from vents near the center of the basin, almost filling the depression. So copious and rapid was this discharge that support was withdrawn from beneath the vents and wholesale engulfment ensued. The present Lake Ilopango lies within the resultant *caldera*. Collapse took place in post-Pleistocene time. Finally, a new volcano rose from the floor of the lake in 1880: this is a dome of dacite of Peléan type.

Basic Assumption Underlying Paleoecology

W. P. Woodring, *U. S. Geological Survey*

Reconstruction of the environment of animals that lived during past geologic time is perforce based on the assumption that the animals indicate essentially the same environment as modern animals to which they are closely allied. This assumption has at times been abused by violation of the "closely allied" clause. When properly used, it is justifiable, but, like other generalizations, is

of doubtful validity for some samples. An example of doubtful validity is afforded by the late Pliocene and Pleistocene marine mollusks of California, including even fossils that are indistinguishable from modern species—or are closely allied to modern species—on the basis of morphological characters available to paleontologists.

Modern species that are found as fossils beyond their present geographic range are generally held to be indicators of a corresponding shift of the environment, due to climatic or other change. In the absence of conflicting evidence that inference is plausible. The late Pliocene and Pleistocene marine molluscan faunas of California, however, present conflicting evidence as indicators of past temperature. Species that are north of their present geographic range are found in direct association with species that are south of their present range.

This conflicting evidence might be resolved by postulating subsequent evolution in physiological characters that shows no correlation with evolution in morphological characters available to paleontologists, or by postulating the rise and extinction of local subspecies—or species—differentiated by physiological characters unknown and unknowable to paleontologists.

It is suggested that determinations of temperature coefficient, based on the ratio of the isotopes O^{18} to O^{16} in the calcium carbonate of the fossils, should show whether the conflicting evidence is as irreconcilable as it now appears to be.

The Limiting Negative Pressure of Five Organic Liquids and the 2-Phase System, Water–Ice

Lyman J. Briggs, ***National Bureau of Standards***

The limiting negative pressure of the following liquids has now been investigated by a centrifugal method, through the temperature ranges indicated: acetic acid, 16° to 52° C; aniline, – 6° to 53° C; benzene, 6° to 32° C; carbon tetrachloride, –16° to 35° C; chloroform, –15° to 27° C.

The first three liquids all show a maximum in the limiting negative pressure within the temperature range specified, the measurements in each case extending to near the freezing point. In this respect they act similarly to water. The freezing points of the other liquids were beyond the range of the apparatus.

The limiting negative pressure of each of the liquids measured, except benzene, is comparable with, or greater than, that of water, 275 bars. Benzene, a nonpolar liquid, has a maximum value only about one half that of its strongly polarized ($\mu = 1.48 \times 10^{-18}$) derivative, aniline. Chloroform ($\mu = 1.02 \times 10^{-18}$) is greater than nonpolar carbon tetrachloride, but the difference is much less marked. The method employed thus appears to provide a way of measuring directly the contribution of the dipole to the cohesive forces in a liquid by comparing the limiting negative pressure of the *cis* and *trans* forms.

The limiting negative pressure at the interface between ice and water has been measured by freezing the central section of the spinning liquid column, the temperature of the rest of the system being held a little above the melting point. The instant of rupture was detected by the escaping water breaking down the insulation of a filter-paper condenser surrounding the spinner. The limiting negative pressure observed was 8–10 bars, which is consistent with measurements reported last April on water near its freezing point. The negative pressure of ice at 0° C is then equal to or greater than 8 bars.

Radioactivities of the Ordinary Elements; New Data and Systematics

W. F. Libby, ***University of Chicago***

Measurements in the past few years have revealed the existence of two new naturally radioactive elements, rhenium and indium, and have set new and stringent limits on the possible radioactivities of other elements. These new data are presented in a summary form. In addition, more accurate measurements on the decay characteristics of several of the naturally occurring active isotopes have been reported. These data seem to suggest certain regularities that may have general interest.

Television as an Educational and Scientific Tool

V. K. Zworykin and L. E. Flory
Radio Corporation of America

Television as an entertainment medium is far advanced and as such is rapidly taking its place with the radio and the movies. Looked upon in its broadest sense, however, television has potentialities extending far beyond those in the entertainment field. In the ultimate, television can be said to be an extension of human vision—not only in distance, but also an extension of color sensitivity into regions of illumination invisible to the eye.

As such an adjunct to vision, television has tremendous possibilities in science and education. Special television equipment, compact, simple to operate and reliable, has been developed for these uses. One of the most promising scientific applications of television is its use in connection with the light microscope. In this application the eye is replaced directly by the television camera, and the image of the microscopic specimen is seen on the television monitor, which may be of any size from the smallest television tube up to full theater screen size for large groups. This method, aside from the added convenience of viewing and its possibilities in classroom instruction, provides an enhancement of contrast that permits the observation of living cells under conditions of contrast previously obtained only by killing and staining. In addition illumination of any wavelength from the red or infrared down to 2,500A or lower may be used, permitting direct observation of structures of tissues and other materials previously possible only by photography. Living organisms may be viewed by certain wavelengths of the ultraviolet, limited only by the killing power of the illumination.

Televised Microscopy in Biological Research

A. K. Parpart, ***Princeton University***

The importance of televised microscopy for research in biology arises from the very significant increase in contrast, the wavelength selectivity not only in the visible but in the ultraviolet, and in the case of following motion within and of a cell at high magnification (×4,000).

A striking example of these three features has been obtained in the erythrocytes of elasmobranchs. Small granules (0.2–0.4 μ) in the cytoplasm have been observed in Brownian and translatory motion within these cells. This has made it possible to establish that there can be no fine meshwork reticular structure within the cytoplasm of these cells. It can therefore be said that the normal shape and the changes in shape resulting in hemolysis are

the resultant of surface changes in these cells rather than due to an organized internal structure.

Experiments with Π⁻-mesons from the Nevis Cyclotron

E. T. Booth, ***Columbia University***

Negative π-mesons of 75 mev kinetic energy are produced in the Columbia cyclotron by allowing 385 mev protons to strike a beryllium target inside the accelerating chamber. Mesons projected in the forward direction from the target are deflected by the magnetic field of the cyclotron and are allowed to pass through an opening in the concrete shield surrounding the machine. In this way a particle flux of 10 mesons/cm²/sec is obtained in a shielded experimental area.

Experiments conducted both with a cloud chamber and with photographic plates in this meson beam are discussed. Cloud chamber results are presented of the interactions of these mesons with a carbon plate placed in the chamber. Nuclear plate studies of the interactions of the mesons with emulsion are also reported.

Investigations with the MIT Synchrotron

B. T. Feld, ***Massachusetts Institute of Technology***

The MIT electron synchrotron is operating at energies up to 340 mev. Electrons fall on a thin tungsten target, producing a beam of x-rays which is collimated and then allowed to fall on a target. Current and contemplated experiments discussed include the following:

1. Mean life and decay scheme of positive π-mesons.
2. Spectrum and angular distribution of charged π-mesons produced in H, D, and C; mesons detected in photographic emulsions; H and D results obtained by difference between paraffin and carbon.
3. Cross section for charged meson production by various elements; mesons detected by liquid scintillation counters.
4. Production of neutral π-mesons in hydrogen gas, by detection of the proton recoils in photographic emulsions.
5. Scattering of γ-rays by protons in the energy region of the meson production threshold; detection same as for (4).
6. Direct observation of meson production in electron-sensitive nuclear emulsions.
7. A search for the creation of μ-meson pairs, using liquid scintillation counter detectors.
8. Spectrum of electrons from μ-decay, observed in a cloud chamber.
9. Study of absorption of negative π-mesons in pure materials; high-pressure and ordinary cloud chambers.

Recent Work on Mesons at the University of California Radiation Laboratory

C. Richman, ***University of California***

The study of mesons with the use of the Berkeley synchrotron and synchrocyclotron has been, first, a study of the production of mesons. It has been found that π^{+-}, π^- and π^0-mesons are produced by the bombardment of nuclei by γ-rays as well as by nucleons. The detection of the π^0-meson by the coincidence of 2 γ-rays into which it decays shows that it is not a particle of spin $\frac{1}{2}\hbar$ or $\hbar$. Its spin is therefore probably 0. For comparison with the theory the production of mesons from hydrogen is particularly interesting. A study has been made of the reaction $\gamma + P \rightarrow N + \pi^+$. In the proton-proton collision two reactions have been found $P + P \rightarrow N + P + \pi^+$ and $P + P \rightarrow D + \pi^+$.

The capture of π-mesons by nuclei has been studied. In hydrogen two reactions take place, $\pi^- + P \rightarrow N + \gamma$ and $\pi^- + P \rightarrow N + \pi^0$. In deuterium the reactions are $\pi^- + D \rightarrow N + N$ and $\pi^- + D \rightarrow N + N + \gamma$.

Current Research with Mesons from the Rochester Cyclotron

A. Roberts, ***University of Rochester***

The 130-in Rochester cyclotron operates at present with a beam of about 0.1 μa of 240 mev protons. A suitable target produces a flux of π^{+-} and π^--mesons, which are deflected by the fringing field to approximate foci outside the cyclotron tank, but close to it. By taking special precautions, the meson beam can be selectively detected by a scintillation counter telescope. Present maximum flux values are about 250 π^+-mesons/min/cm² at 40 ($\pm$1) mev, and about a tenth as many π^--mesons. Detection by photographic plates or cloud chambers is handicapped by high background intensities.

Current research with mesons is concerned with measurement of the relative yields of π^{+-} and π^--mesons, the E dependence of meson production, preliminary work directed toward measurement of meson scattering, and an attempt to measure the cross section for the process $\pi^+ + d \rightarrow 2p$. Since the cross section for the inverse of this process has been measured at Berkeley, the measurement should give, by detailed balancing considerations, the spin of the π^{+-}-meson.

High-Energy γ-Ray Studies at Cornell

Robert R. Wilson, ***Cornell University***

The Cornell synchrotron gives 310 mev electrons in pulses at 30 cps. The γ-ray intensity produced by these electrons is about 10^6 r/hr behind $\frac{1}{8}$ = Pb at 1 meter. The spectrum has been carefully studied using a pair spectrometer, and is observed to follow closely the Bethe-Heitler theory.

Mesons produced by these γ-rays have been studied in a variety of ways. The neutral meson production in protons has been looked at by observing the recoil of the proton. Silverman and Stearns find the cross section at 300 mev at 90° to be about 10 μb/steradian/γ.

A nearly pure beam of charged mesons is separated by a two-magnet focusing system. The scattering and absorption of these mesons have been studied, using a cloud chamber containing thin plates through which the mesons pass. In light elements such as Al and C, nearly elastic large-angle scattering is observed, as well as star production. It is possible to separate the elastic shadow scattering, which is particularly sensitive to the transparency of the nucleus. Preliminary results indicate that the carbon nucleus is slightly transparent to incident mesons.

The production of charged mesons has also been studied in a number of materials. At 135° from the direction of the incident γ-ray beam and at an energy of about 50 mev, the π^-/π^+ ratio for carbon is 1.04 $\pm$.05; for Be, 2.2 $\pm$.1; for D, 1.4 $\pm$.2; for S, 0.78 $\pm$.05. The ratio of π^+ per proton to π^+ per deuteron is 1.20 $\pm$.16.

Technical Papers

Transmission of *Plasmodium relictum* Grassi & Feletti by *Anopheles freeborni* Aitken[1]

Frances F. Mok

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The successful transmission of *Plasmodium relictum* from canary to canary by *Anopheles freeborni* is described in this note. A number of culicine mosquitoes have been reported by previous workers to be capable of serving as hosts to *P. relictum*. More recently two species of anopheline mosquitoes, *Anopheles quadrimaculatus* and *Anopheles crucians* were added by Hunninen *et al.* (*1*) as susceptible hosts to *P. relictum*. The mosquito transmission of this parasite by *A. freeborni* has not thus far been reported.

The original sources of the *P. relictum* used in these experiments were 2 house finches caught in Berkeley, Cal., in September 1950. The infections were transferred from finches to canaries by the intravenous injection of citrated blood. The mosquitoes used were *A. freeborni* and *Culex pipiens molestus*; the latter was used as control. All the mosquitoes came from laboratory colonies.

Specimens of both species of mosquitoes were fed simultaneously on infected canaries having a gametocyte count of approximately 1/100 erythrocytes and kept in the insectary (74°–80° F and 80–92% humidity) during the development of the exogenous stages.

At intervals from 7 to 30 days after the initial meal, the mosquitoes were allowed to feed on parasite-free canaries. As soon as the mosquitoes had bitten, they were killed and dissected, the salivary glands examined for sporozoites, and the stomach for oocysts. The canaries were placed under observation after being bitten by mosquitoes with sporozoites in the glands.

Stomach dissections indicated that 7 (11.1%) of 62 *A. freeborni* were oocyst-positive from the 8th to the 21st day after biting. The number of oocysts per stomach ranged from 1 to 18, with an average of 4. Sporozoites were observed in the salivary glands of 5 (8.06%) *A. freeborni* on the 18th and 21st days. Three clean canaries were bitten by these sporozoite-positive mosquitoes, 2 of which were found to have a patent infection on the 9th and the 10th days, respectively. One did not become infected over a 33-day examination period.

Of the 94 *C. p. molestus* dissected, 26 (27.6%) were found to contain oocysts. The number of oocysts per stomach varied from 3 to 47, with an average of 15.3. Sporozoites were found in 14 instances in the period of 10–21 days after the infective feed. Five canaries were bitten by those that showed sporozoites in their glands. One bird became infected on the 8th day, 2 on the 9th, and 2 on the 10th day.

The findings described provide further evidence of the ability of anopheline mosquitoes to transmit avian plasmodia.

[1] This research was suggested by, and carried out under the direction of, Deane P. Furman, whose supervision is gratefully acknowledged.

Reference

1. Hunninen, A. V., Young, M. D., and Burgess, R. W. *J. Natl. Malaria Assoc.*, **9**, 145 (1950).

Inhibitory Effect of Cortisone on Dietary Necrotic Liver Degeneration in the Rat

Klaus Schwartz[1, 2]

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Degeneration of the liver leading to necrosis, hemorrhage, sudden coma, and death can be induced experimentally by a diversity of dietary means. In earlier experiments, liver degeneration was produced by 15% of a special alkali-treated casein, so-called casein VI, in synthetic diets (*1–4*). Many substances were tested for protective activity against this injury during 1940–43. This work led to the discovery of vitamin E as a liver-protecting agent (*2*). It was observed at that time that total lipoid extract from adrenals inhibited the development of the disease (*1*).

A severe but somewhat different type of dietary liver injury is caused by incorporation of large amounts of certain yeasts as protein source in synthetic diets, as shown by Hock *et al.* in 1943–4 (*5–7*) and Glynn and Himsworth in 1944 (*8*). It has been demonstrated that this condition is the result of the simultaneous inadequacy of the diet in at least two important respects. Cystine-methionine, on the one hand, and vitamin E, on the other, must be lacking at the same time in order to induce liver degeneration. Each of these substances alone can prevent the defect caused by yeast diets (*9*).

Disturbances of carbohydrate metabolism are under investigation in current experiments with young rats on a 30% yeast diet.[3] Lack of glyconeogenesis seems to be one of the essential features of liver degeneration (*10*). Cortisone (Kendall's Compound E, 17-

[1] Special research fellow, U. S. Public Health Service.

[2] The author acknowledges the technical assistance of Louis E. Lowman and Jerome H. Epstein.

[3] Composition of the diet: yeast 30%, sucrose 59%, lard (freed from vitamin E by molecular distillation, Distillation Prod., Inc.) 5%, salt mixture 5%, vitamin mixture in lactose 1%. One hundred-g diet contained the following supplemented vitamins: B_1 · HCl 400 γ, B_2 250 γ, B_6 · HCl 200 γ, Ca Pantothenate 400 γ, choline chloride 1,000 γ, niacin 1,000 γ, vitamin K (2-methyl-1,4-naphthoquinone) 100 γ. 50 γ crystalline vitamin A and 1 γ vitamin D_3 were administered once weekly in 0.02 ml ethyl laurate.

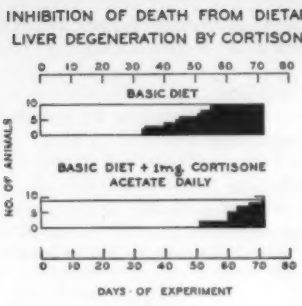

FIG. 1.

hydroxy-11-dehydrocorticosterone) is known to be a potent stimulator for glycogen formation in the liver (*11*). We have found that cortisone acetate has a delaying action on the development of liver degeneration in rats when given subcutaneously in daily doses of 1 mg/100 g of body weight (Fig. 1).

In 10 animals on a 30% yeast diet without cortisone, coma and death occurred after 33–60 days of the experiment, the average survival time being 45.2 days. The mortality was 100%. One out of 10 animals with cortisone died after 26 days with severe kidney damage; the liver was normal. The other 9 animals with cortisone survived the 50th day, whereas 7 out of 10 without cortisone were dead because of liver degeneration at this time (Table 1). Continued application of

TABLE 1

INHIBITION OF DIETARY LIVER DEGENERATION BY CORTISONE

	No. animals	Dead because of liver degeneration		Survival time (av)
		At 50th day	At end of experiment*	
Yeast diet	10	7	10	45.2 ± 3.50†
Yeast diet + cortisone acetate, 1 mg daily subcutaneously	9	0	9	60.0 ± 2.35†

* 71st day.
† Standard deviation of the mean.

the hormone, however, did not prevent the injury. The animals succumbed between the 51st and the 72nd day, the average survival being 60 days. Cortisone thus prolonged the average life span by about 15 days.

All rats on cortisone had an adrenal atrophy and an involution of the thymus. Two of them developed a marked symmetrical alopecia of the posterior body region. Separate analysis of the data for males and females showed no difference between the sexes in response to the hormone (Table 2); the number of animals, however, is too small to draw significant conclusions. The finding that females live longer than males is customary in our experiments with liver degeneration resulting from yeast diets.

TABLE 2

RESPONSE OF MALES AND FEMALES TO CORTISONE (No. of Animals in Parentheses)

	Average survival time (in days)	
	Males	Females
Without cortisone	41.5 (6)	50.1 (4)
With cortisone	57.0 (5)	65.2 (4)
Difference due to cortisone	15.5 days	15.1 days

In Europe, adrenal cortical hormones have been used extensively for the treatment of parenchymal liver diseases, specially in cases of epidemic hepatitis, and have been claimed to be efficient (*12*). It will be of interest to learn whether the introduction of Compound E will be of additional value in this field.

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The Anterior Process and the Ossification of the Malleus in Mammals

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The view generally held regarding the ossification of the malleus in man (*1, 2*), as well as in other mammals (*3*), is that the bone ossifies independently of its anterior process. In man, the center of ossification of the malleus appears near the neck, whereas the anterior process ossifies separately in membrane and joins the main part of the bone about the sixth month of fetal life (*2*).

Studies on the temporal region in alizarin-stained preparations in a number of embryonic and post-embryonic stages of *Hemiechinus* (Insectivora), *Rousettus, Taphozous,* and *Tadarida* (Chiroptera), and *Mus* and *Gerbillus* (Rodentia) have not revealed

the presence of centers of ossification in the cartilage of the developing malleus. The process of ossification of the malleus was found to start in the goniale (anterior process) and to proceed into the lamina and head of the developing malleus (*4*).

Serial sections of the temporal region in *Rousettus, Taphozous,* and *Gerbillus,* moreover, reveal that at a certain stage (the 16-mm head stage in *Rousettus,* the 11-mm head stage in *Taphozous,* and the 13.5-mm head stage in *Gerbillus*) the relation of the anterior process to the cartilage of the developing malleus is similar to that of the dentary to the distal part of Meckel's cartilage. This part of the lower jaw, which lies between the mental foramen and the symphysis mentis, was formerly thought to ossify from a separate center, and the mandible itself was considered as ossifying from 6 centers. The early researches of Fawcett (*5*) and of Low (*6, 7*) on the development of the mandible in man and in other mammals, now widely accepted, indicated that the mandible is formed from a single center, which appears near the mental foramen about the sixth week of fetal life. By the tenth week the portion of Meckel's cartilage that lies below and behind the incisor teeth is surrounded and invaded by the membrane bone.

In all the species examined by the writer the malleus was found to ossify in a manner not dissimilar to that of the distal part of Meckel's cartilage. The identity of the process in the two cases may be summarized as follows: The single center of ossification of the mandible—namely, the dentary—appears near the mental nerve. The portion of Meckel's cartilage in front of the mental foramen is surrounded and invaded by the membrane bone. For the malleus there is also a single center, the anterior process, which in the early stages develops around the chorda tympani nerve. The portion of Meckel's cartilage behind the foramen for the chorda tympani is surrounded and invaded by the membrane bone.

Reference may, however, be made to the following observations: Haines (*8*) found that the angular in some teleosts (*Mugil, Sardina,* and *Trigla*) invades the perichondrium and the posterior end of Meckel's cartilage to form the joint surface, the articular. Kingsley (*9*) referred to the peculiar method of ossification of the articular in Amphibia: ossification starts first as ectochondral bone which later invades the cartilage.

Should we speak of centers of ossification of the malleus, we would have to seek in the anterior process the sole center. For it the name "membranous center" is here applied, a term which has been proposed by Fawcett (*5*) for the dentary of the mandible.

Full details of this study will be published elsewhere.

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Barrier Island, Not "Offshore Bar"[1]

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It is time for students of shorelines to standardize their terminology by removing ambiguous terms, discontinuing double uses of the same term for different features and multiple terms for a single feature. The terminology of bordering islands ("barrier sand reefs") and miscellaneous "offshore" bars needs such standardization. Some specific changes are suggested here that seem to be especially needed at this time in view of the widespread attention being given to marine geological problems and the emergence of a specialty of geological oceanography. Other revisions of the terminology of barlike structures, including the modern use of the ancient eolian term "dune" for a somewhat dunelike underwater bar, are not discussed.

Douglas W. Johnson in his shoreline treatise (*1*) gave an extensive analysis of the form and origin of the sandy barrier bar or island of gently sloping shoreline bottoms, such as those of coastal plains. He concluded that the structure originated largely as a bar or bars formed offshore—normally submerged—and that the driving into shallow water of a series of such bars and their up-building there led to the emergence above normal tidal range of a barrier island. Hence, he adopted the term "offshore bar" for the island.

Johnson's hypothesis of the origin of the barrier island and the use—though somewhat ambiguously (*2*)—of his "offshore bar" as a criterion of "emergent shorelines" attracted much attention and fixed the use of the term "offshore bar" in the minds of many geologists. The class of normally submerged bars formed offshore which, in Johnson's view, contributed largely to the origin of the barrier island was left without a specific name, to be called merely *bars.*

Students of modern sedimentation who have not also been closely concerned with the geomorphology or structure of the barrier island itself seem to have overlooked Johnson's appropriation of "offshore bar" and continue to use the term for true bars lying in various offshore positions, typically just beyond and below normal low tide levels. This situation has caused time-consuming confusion, specifically for this writer in some transoceanic correspondence.

Textbooks of geomorphology and geology have not, so far, arrived at a full standardization of coastal terminology. This deficiency is evident in the two current texts on marine geology or geological oceanography. Thus, F. P. Shepard's *Submarine Geology* (*3*) speaks on one page of the barrier island as an "off-

[1] Contribution from the Department of Oceanography of the Agricultural and Mechanical College of Texas, No. 9.

shore bar," but on another uses the same term for any one of a series of normally submerged bars found at increasing depths on and seaward from a gently sloping beach. Ph. H. Kuenen's *Marine Geology* (*4*) seems to use "offshore bar" only in the Johnsonian sense, but repeats Shepard's figure (*3*, Fig. 33; *4*, Fig. 121) in which a bar is shown in the offshore zone of the beach without providing a specific qualifying term for such a bar. Kuenen's contribution to the confusion in the use of "offshore bar" is to term some of them "sandbanks" (*4*, 270, and Fig. 124), thus attempting to appropriate for a specific technical meaning a term long in wide common use for any kind of sandy beach, dike, or levee. Kuenen's "sandbank" is the ridge in the "low and ball" topography. Such bars have lately been termed "longshore bars" by Shepard (*5*).

The following terminology is proposed to correct the ambiguity and double uses noted:

1. *Offshore bar*: any normally submerged bar formed offshore in marine or fresh waters, found chiefly in the littoral zone. It includes, among other bars, the ridges of the low and ball topography that have been called "sandbanks" by Kuenen and "longshore bars" by Shepard, the latter being here preferred. To term such a ridge a "sandbank" has no more distinctiveness than to call it a "ball."

2. *Barrier island*: the island, or chain of islands of sand, or sand and gravel or shingle, lying offshore on a gently sloping shallow bottom. It is separated from the shore by a coastal lagoon or "sound." Its beach is the main line of resistance of the land to the attack of the major waves of the offshore region, the beach slope forming a profile of equilibrium. The term is used technically and includes, as a single barrier island or *barrier island chain*, such segments in the same alignment as may be separated by tidal inlets or other tidal openings. This barrier is commonly tied to land at one or both ends, either to a stream delta or to a headland of some other origin, as an erosional projection of a drowned coast. The segments of the island or chain may include spitlike peninsulas, the difference between spit and spitlike segment of a barrier island being one of size and individual usage, as in the case of hill and mountain. Synonyms: Barrier beach, offshore bar (Johnsonian sense), and barrier sand island. The term "barrier beach" is not favored because many barrier islands are much more than beaches, being widened by washover fans, tidal deltas, and eolian plains and prograded to form extensive beach plains and cuspate forelands.

3. *Barrier reef*: an organic, commonly partly coralline reef lying offshore from a continent or island much in the position of the barrier island of sand. It includes barrier reefs of islands—commonly volcanic—and such great barrier reefs as that of the northeastern Australian coast. The terminology of coralline reefs is fairly well stabilized and has recently been summarized, with some additions, by Kuenen (*4*, 423–26).

It seems remarkable that our geological terminology is as well organized as it is in view of such obstacles as (1) the characteristic use in English of one word in multiple meanings, (2) the incompleteness in scope of our scientific dictionaries, (3) the general brevity and sketchiness of book indices, and (4) the relative scarcity of detailed treatises of the scope of Grabau's *Principles of Stratigraphy* and Twenhofel's *Treatise on Sedimentation*, in contrast with the abundance of textbooks suitable for review in a one- or two-semester course of graduate or undergraduate instruction. Some of these shorter textbooks of geology present somewhat individualistic terminologies.

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A Device for Air Evacuation from an Autoclave Sterilizer

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In employing autoclave sterilization, it is best to have the substance to be sterilized entirely exposed to steam. If some air is allowed to remain in the chamber of a sterilizer, incomplete sterilization will result.

Obviously, devices for displacement of air have always been taken into consideration, as seen in the construction of almost all sterilizers. The most common ones are the vacuum and the sensitive thermal devices. The former, however, produces only partial vacuum and is time-consuming, and the latter fails to remove that part of air which has mixed with steam. The present device (Figs. 1–4) has been found satisfactory in actual practice.

As the density of steam is smaller than that of air ($18/22.4 < 29/22.4$), and its temperature much higher ($100° > 20°$ C), the ratio of their densities becomes all the greater ($293 \times 18/373 \ll 29$). So as soon as steam is led into the jacket and the chamber, its natural tendency will be to rise and occupy the upper part of the chamber, and the air already there will be pressed to the lower part. Under such circumstances, the supersaturated steam becomes so unstable that it separates into small droplets when it diffuses downward into the dead air space. Likewise, as a result of upward diffusion, the air loses its mixing effect with the steam owing to the condensation of the latter.

If the steam pressure is not high (< 3 psi), and a baffle plate is placed in front of the inlet, the phenomenon of eddy current will be avoided. In this case, the air and steam will not be a mixture, but separate layers, each of which possesses a uniform tempera-

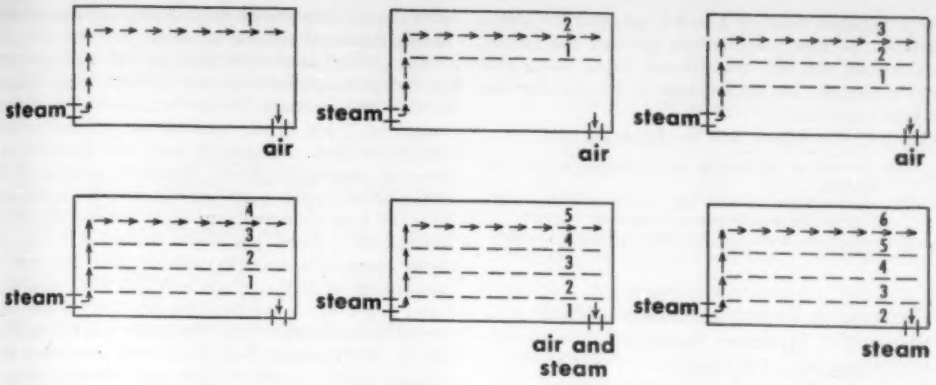

Fig. 1

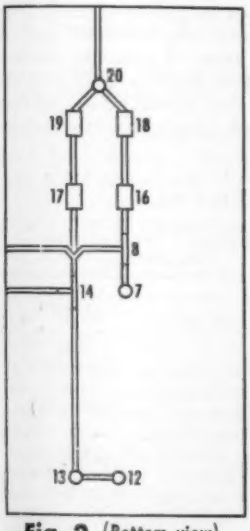

Fig. 2 (Bottom view)

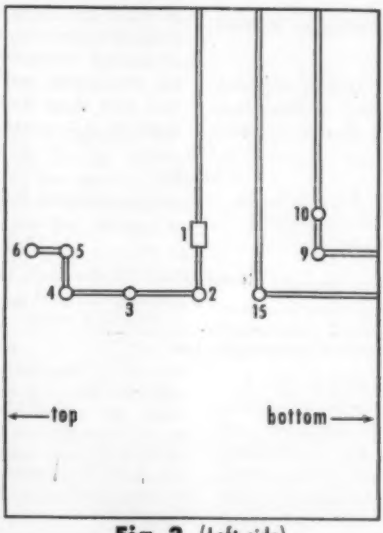

Fig. 3 (Left side)

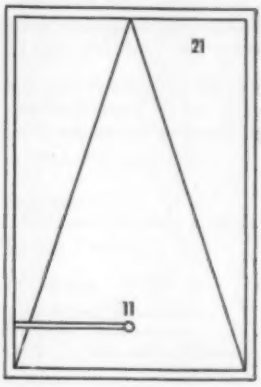

Fig. 4 (Rear view)

Explanation of figures

1. Steam strainer
2. Valve (steam to jacket)
3. Reducing valve
4. Jacket pressure gauge
5. Safety valve
6. Jacket steam inlet
7. Jacket steam and condensate outlet
8. T-tube
9. Valve (steam to chamber)
10. Chamber pressure gauge
11. Chamber steam inlet
12. Chamber steam and condensate outlet
13. Thermometer
14. T-tube
15. Exhaust-valve
16, 17. Strainer
18, 19. Steam trap
20. Draining pipe
21. Baffle plate

ture, and the air will occupy the lowest portion of the chamber. Hence, if the inlet for steam is on the top (or lower back) and the outlet on the bottom (or bottom front), it will be in the best condition for the incoming steam to displace the dead air. Our present device is based on this principle.

In order to avoid eddy current, lead steam slowly into the jacket to press the air originally there into the chamber (Figs. 2, 3, and 4). When all the air is thus displaced, the steam begins to flow into the chamber. In the same way, the steam soon expels all the air out of the chamber through the exhaust valve. This is observed when the temperature at the outlet (13) is approximately equivalent to the chamber pressure (10) (i.e., 2–3 psi ~ 212–215° F). (Analysis shows that air mixed in steam is less than 0.1/100.) Now close the exhaust valve and set the autoclave sterilization in operation as usual.

For free-flowing steam sterilization, the steam pres-

sure is adjusted between 1 and 2 lbs., and the steam is allowed to flow continuously through the jacket, the chamber, and out the exhaust valve. With this simple operation, the temperature in the chamber can easily be maintained at 100° C.

This device is superior in the following ways:

1. The process of displacing air is simple, quick, and complete.
2. The temperature in both the jacket and the chamber is uniform and the performance perfect.
3. It can also be used for free-flowing steam sterilization.

An Enzyme in Endocrine Tissues which Oxidizes Δ^5-3 Hydroxy Steroids to α,β Unsaturated Ketones[1]

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All the most active C_{19} and C_{21} steroid hormones contain the Δ^4-3-one structure in ring A. They have been found in the tissues of origin: thus, testosterone has been isolated from testes (*1, 2*), progesterone from corpus luteum (*3, 4*), and cortical steroids from the adrenal cortex (*5, 6*). Cholesterol and Δ^5-3-ol intermediates are presumed to be precursors of the active hormones. Various tissues were investigated for an enzyme that would convert the latter type of structure to the α,β unsaturated ketone. Placental tissue, corpus luteum, interstitial cells of the testis, and the adrenal cortex were found to be very active, but several other tissues examined showed no effect.

The strong absorption band at 238–240 mμ given by the α,β unsaturated ketonic structure was used for routine measurement of its formation. For the incubations, 2 μM of dry steroid were placed in each incubation flask. The steroid was then dissolved in 1 drop of propylene glycol. Weighed portions of the thinly sliced tissues were washed into the flasks with 15 ml of a solution made up of 1 part of homologous serum and 2 parts phosphate buffer, pH 7.4. The flasks were then brought into equilibrium with an atmosphere of 95% oxygen and 5% CO_2, and incubated for 2 hr. A temperature of 37.5° C was used for all tissues except testis; the latter was incubated at 33° C. Δ^5-Pregnene-3β-ol-20-one was incubated with ovarian follicles, corpora lutea, and adrenal cortex of cattle; cryptorchid testes stimulated with chorionic gonadotrophin, placentae, pregnant uterus, and liver of rats; and three types of tumors of mice. Δ^5-Dehydroepiandrosterone was also incubated with the stimulated cryptorchid testes of rats. The results of the incubations are shown in Table 1. It is obvious that only those tissues that normally form hormones with the α,β unsaturated ketonic structure contained the enzymes. Diphosphopyridine nucleotide appears to be an effective hydrogen acceptor in the oxidation.

TABLE 1

FORMATION OF α,β UNSATURATED KETONES BY VARIOUS TISSUES *in Vitro*

Tissue	Steroid	α,β Unsaturated ketone formed (μM/g/hr)	
		Serum	Serum + 6 μM DPN
Cryptorchid testes, rat (2 testes/flask)	Δ^5-Pregnenolone	0.15 (0.10–0.23)	0.33 (0.31–0.34)
Corpus luteum, cow	"	0.29 (0.25–0.36)	1.00 (0.68–1.34)
Ovarian follicle, cow	"	0	0
Adrenal tissue, cow	"	0.23 (0.21–0.25)	0.76 (0.74–0.81)
Leukemia, lymphosarcoma, mammary carcinoma, mouse	"	0	0
Placental tissue, rat	"		0.19 (0.18, 0.20)
Pregnant uterus, rat	"		0
Liver, rat	"	0	0
Cryptorchid testes, rat	Δ^5-Dehydroepiandrosterone	0.11 (0.06–0.14)	0.32

Since other types of conjugated double bond systems give absorption bands in the same region of the ultraviolet spectrum, an isolation was carried out to establish the structure of the compounds formed in the reaction. Material was isolated after Δ^5-pregnene-3β-ol-20-one had been incubated with cryptorchid testes. The infrared spectrum was that of progesterone. The dinitrophenylhydrazone had the same melting point as progesterone bisdinitrophenylhydrazone. It therefore appears that those tissues which form

[1] This investigation was supported in part by grants from the National Cancer Institute of the National Institutes of Health, U. S. Public Health Service, and from Ciba Pharmaceutical Products, Inc., Summit, N. J.

hormones containing the α,β unsaturated ketone structure also contain an enzyme that will oxidize the Δ^5-3-ol structure to the conjugated form in the presence of DPN as a hydrogen acceptor. This enzyme would appear fundamental in the biological synthesis of these important hormones.

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Morphology of the Ovary of *Oryza Sativa* Linn. Var. *Plena* ("Double Rice")

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The ovary of *Oryza sativa* Linn. is superior, one-celled and contains a single ovule. In the variety *Plena* of the same species Prain (*1*) has recorded that there are as many as 7 ovaries in some specimens, the usual number of ovaries found being 2–5. Neither he nor any other worker has mentioned the number of ovules present in each such ovary. S. K. Mukherjee, Curator of the Herbarium, Indian Botanic Gardens, Sibpur, Calcutta, writes from the notes available in the Herbarium thus:

> After the stamens wither, it is most usual to find that only two ovaries continue to develop and then not infrequently one of these fails to grow as fast as the other; but very often both grow equally, and the result is the "Double Rice." In this case the inner faces of both the grains are flat with a whitish vertical central band, and on section, the embryo of each is found at the outer, or glumal, aspect of the base of the grain. In a few cases three grains are developed, and then instead of having flat faces, they meet in the centre at the white line already mentioned, this line being at the apex of an obtuse angle; the embryo is in each case at the outside, as before.

In the course of our study on this variety, we have observed in several cases the presence of 2 ovules in a single ovary, the number of ovaries being the same as mentioned by Prain (*1*). These ovules grow to maturity side by side. They have 2 integuments each. More than one archesporial cell has also been observed (Fig. 1). Morinaga and Fukushima (*2*) found 2 ovules in an ovary of a haploid rice plant (*O. sativa*) and several ovules with 2 embryo-sac mother cells. In *Inapostol*, a Philippine variety of *O. sativa*, Juliano and Aldama (*3*) also recorded a two-celled archesporium in addition to the normal one-celled. They, however, recorded that only one of them becomes functional. Kuwada (*4*) also found a single instance of a two-celled archesporium in a Japanese variety of *O. sativa*.

Fig. 1. Section of the ovary of "double rice" showing 2 ovules with two-celled archesporium in one of them. (× 475.)

Hence, "double rice" is not only due to the presence of 2 or more ovaries, each containing a functional ovule, but also due to the presence of more than one ovule, generally 2, in each such ovary—a fact not recorded before. Fuller details will be published later.

[1] We offer our sincere thanks to S. K. Mukherjee for supplying us with the notes at the disposal of the Gardens.

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A Root Disease of Plants Caused by a Nematode of the Genus *Trichodorus*

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A root disease of plants that seriously hampers the growing of certain vegetable crops in Florida is caused by a nematode of the genus *Trichodorus* Cobb, 1913. Stubby-root and the stubby-root nematode are suggested as common names for this disease and the causal organism, respectively. Thorne (*1*) places the genus *Trichodorus* in the family Diphtherophoridae of the superfamily Dorylaimoidea. No other member of this superfamily is known to be a serious plant pest, the only ones generally regarded as probably feeding on and injuring the roots of plants being species of *Xiphinema*.

Trichodorus primitivus (deMan 1876) Micoletzky, 1922, was collected first in the Netherlands by deMan, who named and described it (*2*). Subsequently, nematodes that Thorne believed to be the same species were collected by him near Fort Collins, Colo., near San Luis Obispo, Calif., and at various points in Utah, and by Cobb (*3*) near Arlington, Va. The stubby-root nematode is closely related to *T. primitivus*, but because there appears to be doubt in the minds of some taxonomists regarding its specific identity it is herein designated *Trichodorus* sp., pending further study.

Stubby-root has been produced experimentally under conditions sufficiently well controlled to provide

reasonably convincing evidence that *Trichodorus* sp. is in fact the cause. Nematodes of the species in question were isolated from soil collected around the roots of affected plants and, in lots of 100 or more, were transferred in a few ml of water to autoclaved soil. An attempt was then made to build up this nematode population by growing in the soil some suitable plant. In this manner abnormalities of growth have been produced on the roots of beets (*Beta vulgaris*) and sweet corn (*Zea mays*) that were the same as those found on the roots of field-grown plants. In comparable controls, where the soil differed only in the absence of these nematodes, the roots of the experimental plants showed no such abnormalities.

In addition to beets and sweet corn, abnormalities of root growth that, without much doubt, were caused by this same nematode, have been observed on field-grown plants of bean (*Phaseolus vulgaris*), cabbage (*Brassica oleracea capitata*), cauliflower (*Brassica oleracea botrytis*), celery (*Apium graveolens dulce*), chayote (*Sechium edule*), cowpea (*Vigna sinensis*), Lima bean (*Phaseolus limensis*), pea (*Pisum sativum*), pepper (*Capsicum frutescens*), sesbania (*Sesbania emerus*), and tomato (*Lycopersicon esculentum*). Stubby-root is known to occur in the regions of Sanford, Hastings, Winter Garden, Plant City, and Ruskin, Fla.; Auburn, Ala.; Tifton, Ga.; and Florence, S. C. Undoubtedly the disease is widespread in the South and affects a great many different kinds of plants.

The stubby-root nematode is primarily an external feeder, its head very rarely becoming embedded in or attached to the root to such an extent that the parasite can be observed in the feeding position. In a few cases, when roots were removed from the soil carefully and placed immediately in a Syracuse watch glass containing water, large numbers of the parasites were seen loosely adhering to the surfaces of the root tips. They soon left the roots and sank to the bottom of the dish. Even when roots are dug with care most of the nematodes are left in the soil, and if the roots are washed all that remain on them are likely to be removed.

Abnormalities of root growth are caused, for the most part, by injury inflicted at the root tips. In general, necrosis is not very extensive during early stages of the disease, though the amount depends, to some extent, on the kind of plant. In most cases the tips of the roots turn brown, but the roots of some plants, such as corn, may show little or no discoloration, even at the tips. At later stages of the disease there may be a good deal of necrosis, with many of the roots wholly or partly killed, but probably this is due to secondary invaders and other causes.

The disease is especially damaging to seedlings. When a seed is germinating, the growing tip may be attacked and killed while the shoot is very short. It seems probable that injury of this kind is responsible for a great deal of preemergence damping-off. As the first roots of the seedling develop, the tips are attacked and growth is stopped. The roots then form

FIG. 1. Stubby-root on corn seedlings (field-grown plants).

branches, and the tips of these are likewise attacked. The radicle of a corn seedling may be affected but quite frequently escapes injury, at least until it has acquired a moderate length. The roots that develop near the base of the corn stem are quite likely to be attacked, sometimes while they are very short (Fig. 1). Occasionally one or two roots may escape injury and, for a time at least, grow more or less normally. Plants are frequently found whose entire root system has developed from one main root.

The type of root growth that characterizes the disease on older plants varies considerably. If the branches grow to a moderate length before growth is terminated, the tendency is toward the development of a root system composed of short, stubby, sometimes slightly swollen branches (Fig. 2). If the laterals are killed almost as soon as they break through the cortex, the result may be an open root system, with the few roots present largely devoid of branches or with short, knoblike branches. Some plants, like tomatoes, may be severely stunted, yet the roots show no obvious abnormality other than a dearth of small, feeding rootlets. Various intermediate conditions and deviations

FIG. 2. Severe stubby-root on Lima beans (field-grown plants).

from these types may occur, depending on the growth characteristics of the plant, the severity of the injury, and the stage to which the plant has developed before it is attacked. Swellings or galls, comparable to those caused by the root-knot nematodes *Meloidogyne* spp.,[1] do not occur.

The aboveground symptoms are essentially the same as those caused by any condition that deprives a plant of an adequate root system. Growth is retarded, the foliage wilts easily, and the plant has little ability to withstand drought. The foliage of severely stunted plants frequently turns yellow, a condition that may be quite pronounced on corn. It seems probable that such a chlorotic condition is not caused directly by the nematode but is due to some soil deficiency or other condition that is aggravated in the plant through lack of a normally functioning root system.

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[1] Formerly *Heterodera marioni* (Cornu) Goodey.

Attempt to Show Diffusion of Essential Growth Factors from an Induced Penicillin-resistant Culture to the Parent Penicillin-sensitive Strain

Joseph L. Stone

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In 1940 Woods (*1*) showed that PABA, an essential growth factor for many bacteria, was competitively replaced by sulfanilamide, thus inhibiting the susceptible organism. He also demonstrated that bacteria capable of synthesizing PABA were resistant to sulfanilamide, indicating the production of a diffusible metabolic substance to inhibit a chemotherapeutic agent.

Bailey and Cavalitto (*2*) stated that penicillin acts by blocking essential sulfhydryl and possibly amino groups, producing a metabolic block.

Gale and Rodwell (*3*) believe that penicillin-sensitive organisms cannot synthesize many amino acids, especially glutamic acid, whereas resistant organisms can synthesize them from inorganic constituents; penicillin thus acts to impair the ability to assimilate glutamic acid from the medium.

Plough and Grimm (*4*) converted a naturally penicillin-resistant heterotrophic strain of *Salmonella typhimurium* to a penicillin-sensitive cysteine-requiring mutant, indicating that penicillin blocks assimilation of certain amino acids required by the susceptible strain.

Hunter and Baker (*5*) objected to the assimilation-blocking theory of Gale by revealing that a penicillin-sensitive *Bacillus subtilis* may synthesize and not assimilate amino acids, and that some strains of *Escherichia coli*, which synthesize but do not assimilate amino acids, are inhibited by penicillin in high concentration.

In the present study an attempt was made to determine whether an induced penicillin-resistant strain of *Staphylococcus aureus* could synthesize a diffusible product that might supply the parent (penicillin-sensitive) strain with the essential nutrilites to grow in the presence of a lethal amount of penicillin.

The culture used was *Staph. aureus* strain L obtained from Boston University School of Medicine and did not produce penicillinase. The penicillin used was sodium penicillin G (Commercial Solvents Corporation). Resistance was induced as previously described (*6*) by transferring 0.5 ml from the tube of the lowest concentration of penicillin that inhibited to 10 ml of plain broth. After 24 hr of growth the broth culture was used in a penicillin titration of a higher range.

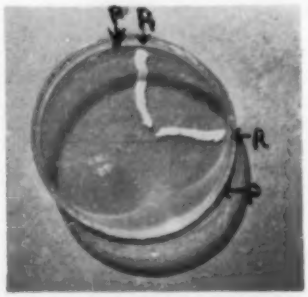

FIG. 1. Penicillin-agar plate. *P*, culture sensitive to penicillin; *R*, culture resistant to penicillin.

To determine possible diffusion of essential nutrilites from the resistant to the sensitive strain, a method described by Davis (*7*), which he used to show diffusion of synthesized products from one culture to a biochemically deficient mutant, was employed. A typical plate is shown in Fig. 1. Nine ml of plain agar at 45°–50° C was added to 1.0 ml of the appropriate concentration of penicillin in a Petri dish. The agar and penicillin were mixed by rotating, and the agar was allowed to harden. Streaks of 24-hr broth cultures of resistant and parent strains were made adjacent to each other to test for diffusion of vital materials from the resistant culture to the sensitive culture. Controls of parent and resistant strains were prepared on the same plate by making streaks at distant parts of the plate.

It appears that generally no essential nutrient was supplied by diffusion to enable the penicillin-sensitive strain to reproduce adjacent to the penicillin-resistant strain. These results favor the theory of Gale and Rodwell (*3*) that penicillin impairs the ability of the culture to assimilate an essential nutrient from the medium, whereas the resistant strain is able to synthesize the substance within its cell. It must also be considered, however, that other mechanisms may be taking place, such as the "learned" ability of the resistant

mutant to grow in the absence of an essential factor without producing this factor.

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An Antidiuretic Substance Obtained by Digestion of Globulin with Pepsin[1]

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Croxatto and Croxatto (*1*) obtained a hypertensive principle (pepsitensin) by treating with pepsin the globulin fraction of plasma that contains hypertensinogen. Also, under these conditions, another substance was formed, with a marked oxytocic effect (*2*). A third substance, which produces an intense antidiuretic action, can be obtained if the extracts containing pepsitensin are digested again with pepsin. This last substance was detected and titrated, using a method described by Burn (*3*).

Rats were used under a water load (5% of body weight), and the different extracts were injected intraperitoneally. Each dose was injected in 4 animals, and the volume of urine measured every 15 min during a period ranging from 2 to 3 hr. Diverse fractions of plasma obtained by precipitation of mammalian blood (human, horse, and ox blood) with $(NH_4)_2SO_4$ were used. These fractions were dialyzed, acidified to pH 3.5, and treated with pepsin (10 mg/100 ml) for 4 hr at 37° C. The fractions were added to 2 volumes of boiling alcohol. The precipitate was then separated, the solvent evaporated, and the final aqueous extracts were reduced to a third of the original volume.

Typical pressor action of pepsitensin was observed in cats and rats, especially after the injection of extracts prepared from fractions that contained hypertensinogen. These extracts also caused an intense oxytocic effect on the isolated uterus of guinea pigs. No antidiuretic effects, or very slight ones, were observed if the extracts were injected intraperitoneally in the rat. An intense antidiuretic action was observed after the injection of the extracts if they were submitted to a second digestion with pepsin (pH 2.5–3.5) for 24 hr, filtrated, and neutralized. It is interesting to notice that these extracts lost their pressor action, maintaining or increasing the oxytocic effect (Figs. 1, 2).

It is possible to assume that the antidiuretic action may be caused by a peptide. It dialyzes slowly through cellophane membranes and is unstable at an alkaline pH.

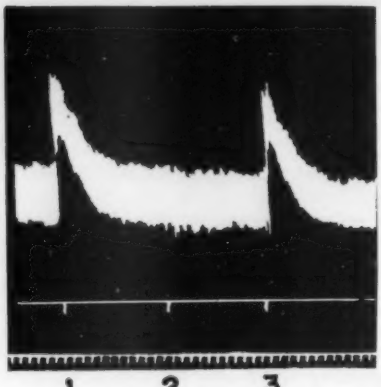

Fig. 1. Blood pressure recording: (1) 1 ml of extract obtained from 7 ml of horse hypertensinogen, plus 0.8 mg of pepsin incubated 4 hr at 37° C; (2) 1 ml of the same extract, following injection after a second digestion with 3 mg pepsin; (3) same as (1).

In spite of the fact that it was not established whether some antidiuretic substance preexists linked to globulins, we believe that most of it is originated by enzymatic hydrolysis from a globulin precursor, as it occurs with hypertensin. If hypertensinogen is treated with HCl (adding no pepsin), no antidiuretic substance is formed. Small yields of antidiuretic substance were obtained from either albumin or fibrinogen.

Our findings indicate that some of the antidiuretic substance obtained from body fluids may have an extrapituitary origin, as has been pointed out by Walker (*4*). Furthermore, these results would also suggest a close relationship among pepsitensin, hypertensin, vasopressin, and oxytocin. Other studies have shown important links between the mechanisms that inactivate neurohypophysis hormones and hypertensin (*5*). Such observations are of interest, especially after the results

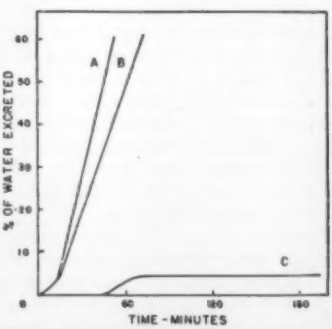

Fig. 2. Urinary excretion curve obtained from 3 groups of rats under a water load (5% body wt). *A*, control group; each rat was injected at 0 with 1 ml of 0.9% NaCl. *B*, group that received 1 ml of the extract injected at 1, Fig. 1. *C*, corresponds to the group that received the extract injected at 2, Fig. 1.

[1] A complete report of this work will be published in *Acta Physiologica Latinoamericana*.

[2] We are grateful to the Fundación Gildemeister for financial help.

obtained by Ellis and Grollman (*6*) in hypertensive patients and in animals with renal hypertension. They showed in both cases an increase in urinary excretion of an antidiuretic substance, most striking in eclamptic women (*7*). Marked alterations in water metabolism were also observed by Braun-Menendez (*8*) in hypertensive rats.

Experiments are in progress to disclose whether an antidiuretic substance might originate through the action of other enzymes, including renin, which is related to hypertensin formation.

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An Internally, Electrically Heated, Sintered Glass Filtration Disk[1]

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A new technique for carrying out filtration at elevated temperatures has been developed, employing a sintered glass disk prepared according to the method previously described by the author (*1*). By the simple expedient of embedding a resistance wire in this disk, the sintered glass filter bed can be uniformly electrically heated. The resistance wire is first threaded into a thin-walled glass tube, bent as shown in Fig. 1.

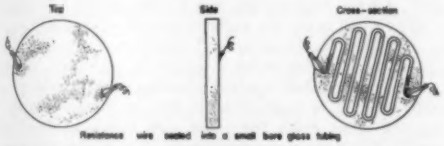

Fig. 1. Internal electrically heated sintered glass disk.

This unit is then embedded in the glass granules and fused in the annealing oven at 600° C. In this way, the heating wires are insulated from contact with the filtering media.

These filtration disks may be constructed in any size or shape, either as independent units, or for incorporation into funnels, tubes, or crucibles (Fig. 2). A glass ring around the periphery of the sintered disk is provided when it is to be used as an independent unit. When the disk is to be incorporated into a funnel or tube, it is first prepared and fused in a carbon mold, which is subsequently removed when the fusion is completed. The disk with its contained heating element is then sealed into the appropriate glass tube or funnel.

[1] Reference may be made to this report noting author, title, source, date, and project and report numbers. The opinions or assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Department of the Navy.

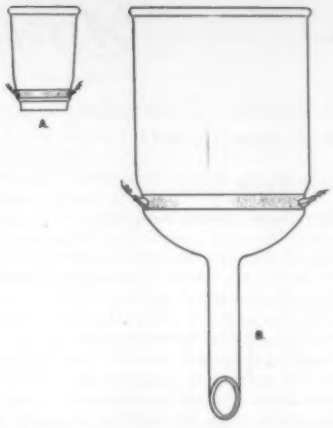

Fig. 2. Electrically heated sintered glass disks mounted in a Gooch crucible (*A*) and a Büchner-type funnel (*B*).

Since the filter is constructed of Pyrex glass granules, the element will withstand temperatures up to 600° C. With rheostatic control of the heating wire, and adequate stirring in the filtering media, proper control of the filtering process can be accomplished. The quantity of material that can be filtered will depend entirely on the area of the filtering disk, and the type of container in which the disk is mounted.

An effective method for the removal of most chemicals that become impregnated on the disk with heating has been found to be the simple procedure of oxidative removal in the annealing oven at temperatures up to 600° C.

The disk described has a number of advantages over other high-temperature filtration units. These consist of (*a*) unobstructed observation of the material during filtration; (*b*) efficient, convenient, and less bulky arrangement for heating and controlling the temperature of the filtering medium; (*c*) relative ease in filtering large or small volumes; (*d*) general versatility, in that the disk can be sealed into any type of apparatus or used in almost any kind of arrangement; (*e*) portability; (*f*) construction of soft glass, Pyrex, quartz, Vycor, etc., to suit the particular needs or the materials available; and (*g*) elimination of the difficulties, so often caused by precipitation resulting from evaporative cooling, where suction is applied to facilitate filtration.

Reference

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Association Affairs

Gordon Research Conferences
June 18–August 31, 1951

W. George Parks

University of Rhode Island, Kingston

THE annual Gordon Research Conferences (formerly known as the Gibson Island Research Conferences), will be held June 18–August 31 at Colby Junior College, New London, N. H., and the New Hampton School, New Hampton, N. H., under the sponsorship of the AAAS.

New London is located on the cross-state highway, Route 11, 100 miles from Boston and 130 miles from Springfield, Mass. The White Mountains are approximately 75 miles from the college. Concord, the state capital, is 35 miles to the southeast, and Hanover (Dartmouth College) is the same distance to the northwest. Two routes are available to the college by train. From Boston individuals attending the conferences should take the Boston and Maine Railroad (North Station) to Potter Place, N. H., which is located 8 miles from New London by automobile. From New York City and the West, New London is reached via Springfield, Mass., and Claremont Junction, N. H. Claremont Junction is approximately 25 miles from New London. If air travel is desired, Concord, N. H., is the nearest airport (35 miles from New London) and is served by Northeast Airlines. Limited bus transportation is available from Boston and Springfield to Potter Place and Claremont. Taxi service is available at Potter Place and Claremont Junction, with special rates for conference members.

New Hampton is located on the state highway, Route 104, 100 miles from Boston and approximately 26 miles from New London. Franconia Notch, N. H., is 40 miles from the school, and Mount Washington (Presidential Range) is 70 miles distant. It is 9 miles to Lake Winnepesaukee, at Meredith, N. H. In order to reach the school by train, the most satisfactory route is from Boston, via the Boston and Maine Railroad (North Station) to Franklin or Laconia, N. H. The school is 16 miles from Franklin and 12 miles from Laconia. Air travel is available to and from Concord via Northeast Airlines. Bus transportation is available from Boston. Transportation will be available at both Franklin and Laconia, with special rates for conference members.

The conferences were established to stimulate research in universities, research foundations, and industrial laboratories. This purpose is achieved by an informal type of meeting consisting of the scheduled lectures and free discussion groups. Sufficient time is available to stimulate informal discussions among the members of the conference. Meetings are held mornings and evenings, Monday through Friday, with the exception of Friday evening. The afternoons are available for recreation, reading, resting, or participation in discussion groups, as the individual desires. This type of meeting is a valuable means of disseminating information and ideas that otherwise might not reach the normal channels of publication and scientific meetings. In addition, scientists in related fields become acquainted, and valuable associations are formed, resulting in collaboration and cooperative efforts between different laboratories.

It is hoped that each conference will extend the frontiers of science by fostering a free and informal exchange of ideas between persons actively interested in the subjects under discussion. The purpose of the program is not to review the known fields of chemistry, but primarily to bring experts up to date as to the latest developments, to analyze the significance of these developments, and to stimulate suggestions as to the underlying theories and effective methods whereby new progress can be made. In order to protect individual rights and to promote discussion, it is an established requirement of each conference that no information presented is to be used without specific authorization of the individual making the contribution, whether in formal presentation or in discussion. Scientific publications are not prepared as emanating from the conferences.

REGISTRATION AND RESERVATIONS

Individuals interested in attending the conferences are requested to send in their applications to the director at once. Each applicant must state the institution or company with which he is associated and the type of work in which he is most interested. Attendance at each conference is limited to 100.

The director will submit the names of those requesting attendance to the Conference Committee for each conference. This committee will review the names and select the members in an effort to distribute the requests as widely as possible among the various institutions and laboratories represented. The names selected will be returned by the Conference Committee to the director, who will notify those accepted as soon as possible. A registration card will be mailed with the notice of selection. Advance registration by mail for each conference is required. On receipt of the completed registration card and a deposit of $25.00, made payable to the Gordon Research Conferences, AAAS, registration will be completed. The deposit of $25.00 will cover the registration fee of $15.00 (except for academic individuals and students on personal expense, who may apply for a reduction of $5.00), the balance being credited against subsistence expenses at the conference. It is hoped that it will be possible to maintain the same rates for room and meals as last year, namely, $2.50 per night per person in a double room with single beds; $3.00 per night per person in a single room; $3.50 per night per person in a single or double room with private bath. Meals served in the dining room were at the rate of $5.75 per day per person. Economic conditions may require these rates to be revised, but a definite statement will be sent with the registration cards. Ten per cent is added to each bill to provide for all gratuities. Members attending a conference are expected to live at the conference. If special circumstances warrant living elsewhere, a charge of $1.00 per day will be made to assist with the financial support of the conferences. The special reduction of 75 cents per day to members attending a conference at personal expense has been discontinued by the Management Committee.

A special fund is provided each year by the Management Committee from the registration fees, to be used to assist academic and government research men or women who have been invited to attend a Gordon Research Conference, but who are not able to attend without serious

financial sacrifices. This fund is provided with the object of increasing the participation of academic and government research men or women in the conferences, and is limited to individuals who have been invited to attend because of the significant contributions they may be able to make, and who will be available for participation in the discussions during the conference.

It is the responsibility of each chairman and the director of the conferences to use this fund effectively in meeting the individual needs of the academic and government participants. It may be used to contribute toward traveling and/or subsistence expenses at the conference, but the money is to be used as an assistance fund only. Total travel and subsistence expenses normally will not be paid.

If it is necessary to cancel a reservation, notice must be received in the office of the director three weeks prior to the conference, whereupon $20.00 will be refunded from the $25.00 deposit. No refund will be made for cancellations received within the three-week period.

The first meeting of each conference is held on Monday at 9:00 A.M., EDST. The morning sessions, through Friday, are scheduled from 9:00 A.M. to 12:00 noon. The second session of each day is held in the evening from 7:30 to 10:00 P.M., Monday through Thursday. Conference members are expected to release their rooms not later than Sunday morning unless they have made a reservation for the next conference.

The public lectures, sponsored jointly by the college and the Gordon Research Conferences, will be organized on Sunday evening preceding several conferences. Conference members usually arrive on Sunday afternoon preceding the conference because it is not possible to obtain public transportation Monday morning in time to arrive for the opening meeting. The schedule of these lectures has not been completed. The tentative dates on which it is hoped to have available an outstanding speaker on a subject of general interest are stated in the program.

Accommodations are available for a limited number of women to attend each conference and for wives who wish to accompany their husbands. All such requests should be made at the time of the request for attendance, because accommodations will be assigned in the order that specific requests are received. Children under eight years of age cannot be accommodated at Colby Junior College; children four years of age and older can be accommodated at the New Hampton School. Rooms are available at several inns and hotels in both New London and New Hampton if reservations are made in advance. Information on these inns and hotels will be supplied by the director on request. No dogs or other animals will be permitted in the dormitories.

Requests for attendance at the conferences or for any additional information should be addressed to W. George Parks, Director, Department of Chemistry, University of Rhode Island, Kingston, R. I. From June 15 to September 1, 1951, mail should be addressed to Colby Junior College, New London, N. H.

Program at Colby Junior College[1]

Catalysis

Otto Beeck Memorial Conference

A. Farkas, *Chairman*; R. C. Hansford, *Vice Chairman*

June 18: H. S. Taylor, "Evaporated Films and Technical Catalysts;" B. A. Fries, "The Hydroforming Reaction: Studies with Carbon-labeled Methylcyclohexane;" P. W. Selwood, "The Structure and Catalytic Activity of Some Amorphous Solids."

June 19: Hugh M. Hulburt, "Electronic Structure and Properties of Oxidation and Hydrogenation Catalysts;" W. A. Weyl, "Surface Chemistry and Heterogeneous Catalysis."

June 20: G. L. Simard, "Studies on Vanadium Oxides as Oxidation Catalysts;" W. J. Kirkpatrick, "The Mechanism of Oxidation of Sulfur Dioxide over Vanadium Pentoxide-Silica-Potassium Pyrosulfate Catalyst;" F. G. Ciapetta, "The Isomerization of Saturated Hydrocarbons by Hydrogenation-Cracking Catalysts."

June 21: R. P. Eischens, "Isotopic Exchange Reactions in the Study of Surface Properties of Iron Catalysts;" L. J. E. Hofer, "The Mechanism of the Carburization of Iron;" R. B. Anderson, "The Preparation of Nitride, Carbonitride and Carbide of Iron and their Behavior in the Fischer-Tropsch Synthesis;" Hartley C. Eckstrom, "Catalyst Composition in Hydrocarbon Synthesis."

June 22: Round-table discussion.

Petroleum

Robert W. Schiessler, *Chairman*; E. C. Hughes, *Vice Chairman*

June 25: V. Haensel, "Platforming of Pure Hydrocarbons;" J. S. Ball, "Sulfur Compounds in Petroleum."

June 26: R. L. Burwell, Jr., "Action of Sulfuric and Chlorosulfonic Acids on Hydrocarbons;" H. L. Lochte, "Nitrogen and Oxygen Compounds in Petroleum."

June 27: H. Pines, "Mechanism of Isomerization of Cycloparaffins;" R. A. Van Nordstrand, "The Structure of Petroleum Waxes."

June 28: B. L. Evering, "Hydrocarbon Isomerization Using Aluminum Chloride and Sulfuric Acid Catalysts;" evening session to be announced.

June 29: To be announced.

Elastomers

Albert W. Meyer, *Chairman*; J. D. D'Ianni, *Vice Chairman*

July 2: Monomers and Polymerization Conditions: F. R. Mayo, Discussion; Maurice Morton, "Quantitative Studies of Emulsion Polymerization;" Polymerization Conditions: Round-table discussion; F. R. Mayo, *Leader*.

July 3: Polymer Structure and Composition vs. Physical Properties and Performance in Service: P. J. Flory, A. W. Meyer and others, "Relationships between Polymer Structure and Properties;" W. O. Baker, "Mechanical Properties of Molecules in Solution;" T. W. DeWitt, "Dynamic Behavior of Polyisobutylene as a Function of Frequency and Temperature;" Robert A. Marvin, "Nonlinear Aspects of Dynamic Properties of Elastomers;" S. D. Gehman, "Effect of Compounding Variables on Dynamic Properties;" J. W. Liska, "Correlations of Dynamic Properties with Service Performance."

July 4: Mechanism of Reinforcement: W. R. Smith and R. L. Zapp, Discussion; John Rehner, Jr., "Thermodynamics of Filler Reinforcement;" B. A. Mrowca, "Study of Reinforcement by Nuclear Magnetism;" E. M. Dannenberg, "Polymer Structure and Response to Reinforcement."

[1] Conference programs that are incomplete in this announcement may be obtained from the Director, University of Rhode Island, Kingston, R. I.

July 5: Vulcanization Reactions: David Craig, Discussion; R. L. Zapp, "The Stoichiometry of Vulcanization;" Geoffrey Gee, "The Present State of Knowledge in the Field of Sulfur Vulcanization;" David Craig, "New Data Concerning TMTD and Sulfur Vulcanization—Effects of Hydrogen Sulfide." Aging Phenomena: B. S. Biggs, Discussion; J. Crabtree, "Rubber and the Ozone Effects;" A. V. Tobolsky, "Some Aspects of Physical and Chemical Changes Occurring during Degradation of Elastomers."

July 6: Aging Phenomena (cont.): J. Reid Shelton, "Oxygen Absorption Studies on Rubber and Related Materials." Silicone Elastomers: E. G. Rochow and others, Discussion.

July 8: Public lecture, 8: 00 P.M. Subject and speaker to be announced.

Polymers

Turner Alfrey, Jr., *Chairman*; Paul J. Flory, *Vice Chairman*

July 9: H. Mark, "Survey of Advances during the Last Year;" W. O. Kenyon, "Chemistry of Derived Polymers of the Vinyl Series."

July 10: W. T. Miller, "Fluoropolymers;" E. M. Fettes, "Structure and Properties of Polysulfides."

July 11: G. B. B. M. Sutherland, "The Use of Infrared Spectroscopy in the Study of High Polymers;" R. S. Marvin, "Report on NBS Dynamic Testing Program;" B. Maxwell, "Tensile Impact Properties of Polymers."

July 12: R. S. Spencer, "Fundamental Analysis of Injection Molding;" H. M. Spurlin and W. H. Markwood, "Residual Stresses and Strains in Molded Plastics."

July 13: S. G. Cohen and H. Haas, "Structure and Properties of Cellulose Ethers."

Textiles

J. H. Brant, *Chairman*; W. J. Hamburger, *Vice Chairman*

July 16: T. Waller George, "Localized Plastic Flowing in Filamentous Solids;" Lyman Fourt, "Obtaining and Measuring Luster in Cotton."

July 17: Eugene Pacsu, "A Critical Discussion of the Structural Problem of Cellulose;" W. E. Roseveare, "The Structure and Reactivity of Cellulose."

July 18: L. P. Herrington, "The Physiology of Clothing;" J. R. Whinfield, "Terylene."

July 19: Milton Platt, "Some Factors Affecting the Translation of Fiber Properties into Yarn Systems;" Ralph G. H. Siu, "Practical Implications of Studies on the Biochemical Mechanism of Cellulose Breakdown by Microorganisms."

July 20: James Wakelin and Herbert Haller, "Research Studies and Processing Trials on Various Wools."

July 22: Public lecture, 8: 00 P.M. Subject and speaker to be announced.

Corrosion

F. W. Fink, *Chairman*; J. M. Pearson, *Vice Chairman*

(*Tentative Program*)

July 23–27: Effect of Minor Constituents on the Corrosion Mechanism Symposia: Harold Robinson, "Light Alloys;" Carl L. Bulow, "Copper-Base Alloys;" C. P. Larrabee, "Low-Alloy Steels;" E. M. Mahla, "Stainless Steels." Summary, R. B. Hoxeng. Thomas May, "Effect of Nickel as a Minor Constituent on Corrosion;" Julius Harwood, "Stress Corrosion and Minor Constituents." Research Papers: Armin H. Gropp, "Polarography in Corrosion;" L. Holzworth, "Solid Solubilities Effects and Knife-Line Corrosion of Stabilized 18 Cr-8 Ni Steels;" Milton Stern, "Corrosion of Aluminum Alloys in Carbon Tetrachloride;" Bruce Dunnington, "A Metallographic Study of High-Temperature Oxidation of Iron."

Instrumentation

H. W. Washburn, *Chairman*; Howard Cary, *Vice Chairman*

July 30: Van Zandt Williams, "Recent Advances in Infrared Instrumentation;" Robert C. Mellors, "Microspectrophotometry;" Bruce Billings, "Interference Filter Spectroscopy."

July 31: J. W. Forrest, "Refractometry;" John Strong, "Instrument Art and Experimental Science;" George W. Downs, "Magnetic Amplifiers."

August 1: P. W. Selwood, "Magnetic Measurements in Physical Chemistry;" W. A. Wildhack, "Instrumentation Research at the Bureau of Standards;" E. C. Miller, "Process Control Instrumentation."

August 2: John Hipple, "Mass Spectrometry of Solids;" Speaker to be announced, "Automatic Mass Spectrometer Process Control;" Speaker to be announced, "Mass Spectrometer for Aqueous Samples."

August 3: Speaker to be announced, "Microwave Refractometry;" Speaker to be announced, "Neutron Spectroscopy."

Food and Nutrition

Bernard L. Oser, *Chairman*; Zoltan I. Kertesz, *Vice Chairman*

August 6: Antibiotics as Food Preservatives: Harold S. Olcott, "Functional Role of Antibiotics in Food Processing;" Edwin J. Cameron, "Criteria of Acceptability for Antibiotics in Food Processing." Antibiotics as Nutrients: James McGinnis, "The Effect of Antibiotics on Animal Growth, Nutritional Requirements and Intestinal Microflora;" Damon Catron, "Effects of Antibiotics in Swine Nutrition."

August 7: Therapeutic Nutrition: Herbert Pollack, "The Increased Metabolic Demands Induced by Injury Response and the Modification of Therapeutic Diets to Satisfy these Requirements;" Stanley M. Levenson, "Some Metabolic and Nutritional Problems Associated with Thermal and Radiation Injury;" Sidney C. Werner, "A Clinical Study of the 'Stress' Response to Operation, Trauma and Disease and Some Consequent Parenteral Nutritional Considerations;" Frank L. Engel, "Experimental Studies on the Relation of the Adrenal Cortex to the Metabolic Reaction to Injury."

August 8: Health Aspects of Exposure to Radioactivity: Howard E. Skipper, "Hazards Involved in Investigations with C^{14};" L. W. Tuttle, "The Question of Radioactive Contamination of Foods." Marine Nutrition: Denis L. Fox, "The Chemical Nature, Measurement and Distribution of Marine Colloidal Matter and its Role in the Nutrition of Animals;" Arthur M. Phillips, Jr., "The Nutrition of Fish with Particular Reference to Vitamin Requirement and Carbohydrate Utilization."

August 9: Geriatric Nutrition: Anthony A. Albanese and Reginald A. Higgons, "Protein Requirements of Old Age;" Agnes Fay Morgan, "Caloric Requirements of Old Age;" Tom S. Hamilton, "Calcium Utilization in

Early and Late Adult Life;" Roy G. Hoskins, "Physiological and Endocrinological Aspects of Aging."

August 10: Chemistry and Metabolism of Polysaccharides: Ralph W. Kerr, "The Action of Amylases on Starch;" Walter Lyon Bloom, "The Intravenous Injection of Polysaccharides."

August 12: Public lecture, 8:00 P.M. Subject and speaker to be announced.

VITAMINS AND METABOLISM

(*Preliminary*)

W. J. Darby, *Chairman*; Gladys A. Emerson, *Vice Chairman*

August 13: A. F. Morgan, "Adrenal, Pantothenic Acid, and Riboflavin Relationships;" Roy Hertz, "The Endocrine Aspects of the Avidin-Biotin Problems;" Charles May, "Relationship of Ascorbic Acid to Metabolism of Folic Acid;" J. H. Burchenal, "Studies of Aminopterin and Citrovorum Factor in the Human."

August 14: Ezra Greenspan and E. B. Schoenbach, "Aminopterin and Citrovorum Formation;" Vincent du Vigneaud, "Transmethylation and Biological Synthesis of Labile Methyl Groups;" D. B. Sprinson, "Some Aspects of the Formation of Methyl Groups."

August 15: J. Loosli, "Role of Vitamin B_{12} and Cobalt in Ruminants;" E. E. Bartley, "Antibiotics in Calf Nutrition;" F. Lipmann, "Chemistry of Coenzyme A;" V. H. Cheldelin and T. E. King, "Chemistry of Bound Pantothenic Acid."

August 16: E. E. Snell, "Purification, Synthesis and Biological Activity of Pantethine and Related Forms of the *Lactobacillus bulgaricus* Factor;" F. C. Steward, "Coconut Milk Factor;" Mary Quaife and P. L. Harris, "Vitamin E in Relation to Acute Physiologic Stress."

August 17: R. W. Vilter, "Desoxypyridoxine-induced Pyridoxine Deficiency in Man;" J. F. Rinehart, "Pathology of Pyridoxine Deficiency."

August 19: Public lecture, 8:00 P.M. Subject and speaker to be announced.

MEDICINAL CHEMISTRY

Otto K. Behrens, *Chairman*; C. A. Winter, *Vice Chairman*

August 20: Robert E. Olson, "The Enzymology of the Normal and Failing Heart;" Rene Wegria, "Pharmacology of Coronary Drugs;" Robert W. Wilkins, "Etiology of Hypertension: A Survey of Current Theories;" George A. Perera, "Criteria for Evaluation of Hypertensive Vascular Disease and its Treatment."

August 21: Josef Fried, "The Chemistry of the Veratrum Alkaloids;" Selby B. Davis, "Control of Renal Blood Flow: An Approach to the Chemotherapy of Hypertension;" Mark Nickerson, "The Pharmacology of Antihypertensive Drugs;" W. C. Hueper, "The Etiologic Factors and Causative Mechanisms in Arteriosclerosis."

August 22: John W. Gofman and Frank Lindgren, "The Role of Lipoproteins in Atherosclerosis with Comments on the Effect of Diet and Various Drug Agents on the Blood Lipoprotein Levels;" Julius Pomeranze, "The Effect of Therapeutic Agents on Serum Lipids and Atherosclerosis;" Karl H. Beyer, "The Relationship of Structure to the Inhibitory Effects of Compounds on Renal Transport Mechanisms;" William P. Boger, "Clinical Status of Agents Influencing Conjugative Mechanisms and Renal Tubular Secretion."

August 23: Klaus R. Unna, "Recent Advances in the Pharmacology of the Myoneural Junction;" Arthur P. Richardson, "The Pharmacology of Drugs Affecting Synaptic Transmission;" Alfred E. Wilhelmi, "Chemical Investigations on the Anterior Pituitary;" Vincent du Vigneaud, "Chemical Investigations on the Posterior Pituitary."

August 24: William J. Haines, "Studies on the Biosynthesis of Adrenal Cortex Hormones;" W. W. Umbreit, "Relation of the Adrenal Cortex to Tissue Enzymes, with Special Reference to Cortisone."

CANCER

M. J. Shear, *Chairman*; G. B. Mider, *Vice Chairman*

August 27–31: General subjects: Components of Tumor Cells, Mechanism of Tumor Genesis, Progress in Chemotherapy, Polysaccharides.

(Speakers and detailed program will be announced later.)

PROGRAM AT NEW HAMPTON SCHOOL[2]

ORGANIC COATINGS

R. H. Kienle, *Chairman*; R. W. Quarles, *Vice Chairman*

June 18: G. M. Powell, "Coatings from Organosol and Plastisol Dispersions;" D. Todd, "Some Rheological Aspects of Vinyl Plastisols."

June 19: O. R. McIntire, "Coatings Properties of Synthetic Lattices;" W. Bosch, "Coatings from Styrene-Butadiene-Drying Oil Emulsions."

June 20: J. D. Ferry, "Properties of Films and Coatings of Biological Origin;" R. Grinsfelder, "Strength of Surface Coatings."

June 21: T. W. Dakin, "Electrical Measurements of Organic Films and Their Interpretation;" S. Gusman, "Studies of the Mechanism of Crater Formation in Baked Surface Coatings."

June 22: S. W. Reinhart, "Theories of Adhesion."

COAL

George D. Creelman, *Chairman*

June 25–29: Fundamental Research on Composition, Properties, and Reactions.

(Speakers and detailed program will be announced later.)

MICROBIOLOGICAL DETERIORATION

J. Leutritz, *Chairman*; G. A. Greathouse, *Vice Chairman*

July 2: Wood and Paper.

July 3: Textiles and Cordage; Leather; Lacquers, Paints and Varnishes.

July 4: Rubber, Resins, Plastics, Waxes, etc.; Chemical Constitution and Biological Effect.

July 5: Organisms and their Metabolism; Preservatives and Fungicides.

July 6: Round-table discussion on Government Specifications for Fungus and Moisture Proofing.

(Speakers and detailed program will be announced later.)

[2] Conference programs that are incomplete in this announcement may be obtained from the Director, University of Rhode Island, Kingston, R. I.

Chemistry and Physics of Metals

Carl Wagner, *Chairman*; Rudolph Speiser, *Vice Chairman*

July 9: F. O. Koenig, "Some General Features of the Thermodynamics of Surface Layers;" J. G. Kirkwood and F. P. Buff, "The Statistical Mechanical Theory of Surface Tension;" H. Udin, "Surface Energy of Solid Metals;" C. J. Calbick, "The Exploration of the Structure of Surfaces and Interfaces with the Aid of the Electron Microscope."

July 10: C. Herring, "The Atomistic Theory of Metallic Surfaces;" L. Apker, "Photoelectric Emission from Solid Surfaces;" R. E. Hoffman, "Surface Diffusion;" A. T. Gwathmey, "Study of Surface Chemistry with the Aid of Single Crystals."

July 11: G. Halsey, "Adsorption on Metallic Surfaces;" A. Wheeler, "Chemical Reactions on Metallic Surfaces;" R. Gomer, "The Kinetics of Nickel Carbonyl Formation;" G. Derge, "Reaction Mechanism at Liquid Slag Iron Interfaces."

July 12: D. C. Grahame, "The Role of Cations and Anions in the Electrolytic Double Layer;" M. T. Simnad, "Local Cell Action and Surface Reactions of Metals in Solutions;" R. L. Fullman, "Interface Energy of Metals."

July 13: D. Turnbull, "Nucleation and Crystal Growth."

Ion Exchange

F. C. Nachod, *Chairman*; K. A. Kraus, *Vice Chairman*

July 16: R. Wheaton, R. Kunin, W. P. Utermohlen, E. B. Tooper, T. R. E. Kressman, and B. N. Dickinson—Round-table discussion on New Ion Exchange Materials, Techniques, and Properties; K. W. Pepper and T. R. E. Kressman, "Ion Exchange Work in Great Britain."

July 17: J. Khym and J. Schubert, "Biological and Medical Applications;" E. W. McChesney and G. J. Martin, "Biological and Medical Applications."

July 18: G. Scatchard and T. Vermeulen, "Exchange Theory (Thermodynamics, Kinetics);" H. F. Walton and K. A. Kraus, "Exchange with Complex Ions and Anion Separations."

July 19: T. Vermeulen and E. R. Gilliland, "Design and Engineering;" W. Juda, T. R. E. Kressman, and K. W. Pepper, "Membranes."

July 20: H. H. Strain, "Ion Migration in Chromatographic Systems."

Statistics in Chemistry

Hugh M. Smallwood, *Chairman*; John W. Tukey, *Vice Chairman*

July 23: Statistics in Analytical Chemistry: Grant Wernimont, Discussion; James A. Mitchell, "Control of Accuracy and Precision of Industrial Tests and Analyses;" John Mandel, "Design of Experimental Work to Develop Analytical Methods;" Joseph Geffner, "Evaluation of the Elementary Causes of Deviations in Spectrochemical Analyses;" Marion M. Sandomire, "Standardization of Test Methods through Inter-Laboratory Tests."

July 24: Role of Statistics in Chemistry: John W. Tukey, Discussion; George Kimball, "Introductory Principles;" William G. Cochran, "Comparative Experimentation;" Subject and speaker to be announced; John W. Tukey, "Empirical Knowledge vs. Insight." Training in Statistics for Chemists: Round-table discussion, leaders to be announced.

July 25: Clinic: At this session, discussion of concrete problems by members of the conference will be carried on. Statistics in Laboratory Experimentation: W. J. Youden, Discussion; Bourdon F. Scribner, "Problems in Spectrochemical Analysis;" Frank Wilcoxon, "The Use of Ranks in Latin Square Designs."

July 26: Statistics in Laboratory Experimentation (cont.): James I. Minor, "Precision Reference Temperatures;" Louis Tanner, "The Selection of Economic Precision Limits for Laboratory Tests." Statistics in Industrial Research: R. H. Noel, Discussion; W. L. Gore, "Resolution of Interactions in Chemical Experimentation;" Allyn W. Kimball, Jr., "Utility of Variance Analysis."

July 27: Statistics in Industrial Research (cont.): Charles A. Bicking, "The Role of Statistics in Increasing the Productivity of Industrial Research;" K. A. Brownlee, subject to be announced; Cuthbert Daniel, "Linear Extrapolation."

General Biochemistry

H. E. Carter, *Chairman*

July 30: J. C. Sheehan, "Synthesis of Peptides;" K. Hofmann, "Synthesis of Peptides;" W. H. Hartung, "Benzyloximino Acid Chlorides;" R. M. Herbst, "Optical Properties of Peptides."

July 31: L. C. Craig, "Fractionation of Peptides;" S. F. Velick, "End Group Labeling of Peptides;" C. H. Li, "ACTH Peptides;" F. Sanger, "DNP Peptides."

August 1: R. B. Johnston, "Transpeptidation;" J. E. Snoke, "Enzymatic Synthesis of Glutathione;" H. Neurath, "The Hydrolysis of Peptides and Peptide Derivatives by Extracellular Proteolytic Enzymes;" J. G. Greenstein, V. E. Price, A. Meister, L. Levintow, and J. B. Gilbert, "Dehydropeptides."

August 2: F. Lipmann, "The Function of Coenzyme A in Acetyl Transfer Reactions;" E. R. Stadtman, "Transacetylation;" H. S. Anker, "Acetylation of Amino Acids;" D. Nachmansohn, "Acetylation of Choline."

August 3: S. Ochoa, J. R. Stern, and S. Korkes, "Enzymatic Synthesis of Citric Acid and Pyruvate Oxidation;" S. Gurin, "Fatty Acid Metabolism."

Current Trends in Analytical Chemistry
Trace Analysis

W. E. Campbell, *Chairman*; J. J. Lingane, *Vice Chairman*

August 6: S. E. Q. Ashley, "Philosophy of Trace Analysis;" C. E. White, "Fluorescence Analysis."

August 7: J. Yoe, "Colorimetric Trace Analysis;" H. Levin, "Trace Analysis of Petroleum Products."

August 8: E. H. Swift, "Colorimetric Trace Analysis;" W. D. Cooke, "Colorimetric Trace Analysis;" L. B. Rogers, "Electrolytic Trace Analysis Involving Radioactive Indicators;" T. S. Lee, "Trace Analysis Involving Electrolytic Reactions at a Rotated Mercury Electrode."

August 9: L. K. Nash, "Trace Gas Analysis;" Speaker to be announced, "Radioactive Tracer Analysis."

August 10: Speaker to be announced, "Isotopic Dilation Analysis."

STEROID CHEMISTRY

T. F. Gallagher, *Chairman*

August 13–17: Recent Advances in the Chemistry of Adrenal Steroids. General topic for presentation and discussion: Total Synthesis.

(Speakers and detailed program will be announced later.)

INORGANIC CHEMISTRY

Present Status and Desirable Future Objectives

W. Conard Fernelius, *Chairman*

August 20–24: General subjects: Coordination Compounds, Crystal Growth, Electron-deficient Fluorine Compounds. Detailed program to be announced.

NUCLEIC ACIDS AND PROTEINS

R. W. G. Wyckoff, *Chairman*; Kurt G. Stern, *Vice Chairman*

August 27–31: The program will include the following topics: The chemistry of and analysis for split products of nucleic acids; certain reactions of proteins; problems of viruses concerned with (*a*) the use of tracers in studying the growth of bacteriophage and (*b*) the nature of the infectious unit of certain plant viruses; mechanisms of the effects of radiation on microorganisms.

(Speakers and detailed program will be announced later.)

News and Notes

Scientists in the News

Three Canadian representatives have been appointed to the International Commission for the Northwest Atlantic Fisheries. They are **Stewart Bates**, deputy minister of fisheries, Ottawa; **J. Howard MacKichan**, general manager, United Maritime Fishermen, Ltd., Halifax; and **Raymond Gushue**, chairman, Newfoundland Fisheries Board. **A. W. H. Needler**, director of the Atlantic Biological Station, Fisheries Research Board of Canada, St. Andrews, was named scientific adviser to the commissioners.

Manson Benedict has been appointed professor of chemical engineering at Massachusetts Institute of Technology. He will also serve as scientific director of the National Research Corporation. He has been director of process development for Hydrocarbon Research, Inc., and is a member of the AEC Reactor Safeguard Committee.

Edward P. Brooks, vice president and director of Sears, Roebuck and Company, has been chosen head of the new School of Industrial Management at MIT. Mr. Brooks goes to his new post in September, and the school, which is to be established with a $5,250,000 gift of the Alfred P. Sloan Foundation, is expected to open late in 1952.

Ernest Cadman Colwell, president of the University of Chicago, has resigned to accept appointment as "the distinguished visiting professor" of Emory University. His resignation leaves vacant both the presidency and chancellorship of the university. Chancellor **Robert Maynard Hutchins** resigned in December to join the Ford Foundation as an associate director, with headquarters in Pasadena, Calif. **Lawrence A. Kimpton** has been named chancellor, but no successor to Dr. Colwell has been chosen.

Bertil Frödin, Swedish engineer and businessman, is a member of the Fifth Chilean Antarctic Expedition. On commission by the universities of Stockholm, Upsala, and Gothenburg, Mr. Frödin will make geographical, glaciological, geological, and botanical observations during the trip to Graham's Land.

Maurice Goldblatt has received the University of Chicago's most distinguished award, the Rosenberger medal, awarded for service in the promotion of human welfare, in recognition of his contributions to the welfare of the city and the University of Chicago, and for his leadership in the national fight against cardiac, cancer, and mental diseases. Mr. Goldblatt is the eleventh recipient of the medal.

The Guyot Prize, awarded by the University of Groningen every fifth year for the most prominent discoveries in the field of ear diseases, has been conferred on **Gunnar Holmgren**, of Stockholm.

Harry N. Holmes, professor emeritus of chemistry, Oberlin College, has been chosen to receive the 1951 Gold Medal of the American Institute of Chemists, in recognition of his "noteworthy and outstanding service to the profession of chemist and the science of chemistry as an able and enthusiastic teacher, author, and investigator." Presentation of the medal will be made at the annual meeting of the institute at Niagara Falls, Ontario, May 9–11.

Willard Rouse Jillson, former state geologist of Kentucky, has resigned his position as professor and head of the Department of Geology at Transylvania College. He will continue his professional work as a consultant in geology and mining engineering at Frankfort.

William D. Johnston, chief of the U. S. Geological Survey's foreign geology branch, has just returned from India, where he represented the U. S. Government and the Geological Society of America at the centenary of the Geological Survey of India in Calcutta, and conferred with governmental, industrial, and scientific leaders on Point Four geological projects. He reported that India is keenly interested in the possibility of sending native geologist trainees to this country under both Point Four and UN provisions.

John A. Straczek, minerals geologist, is in Orissa on a cooperative Point Four manganese investigation, and **George C. Taylor,** ground-water geologist, is working on ground-water resources. Dr. Johnston participated in the Indian Science Congress in Bangalore, in meetings of the subcommittees on iron and steel, and industry and trade, of the UN Economic Committee for Asia and the Far East at Lahore, and other conferences in India and Pakistan. He also spent ten days in Saudi Arabia inspecting Point Four geological projects directed by **Glen Brown** and **Roy Jackson.**

Jacob Korevaar, of Technical High School, Delft, Holland, who was visiting lecturer at Purdue University during 1949–50, has been appointed visiting assistant professor for 1950–51.

Arthur Kornberg, senior surgeon in the Division of Biochemistry, USPHS, received the $1,000 Paul-Lewis Laboratories Award in Enzyme Chemistry at the Boston Meeting of the American Chemical Society. The honor comes to Dr. Kornberg in part because his work has yielded new clues to the mechanism by which sugars and starches are transformed in the living body. He delivered his award address on the "Enzymatic Synthesis of Nucleotides" at a symposium of the society's Division of Biological Chemistry.

Chester R. Longwell, of Yale University, has been elected a corresponding member of the Geological Society of Belgium.

For fundamental research opening the way to broader industrial, pharmaceutical, and medical uses of milk proteins, **Thomas L. McMeekin,** of Philadelphia, received the $1,000 Borden Award in the Chemistry of Milk at the Boston session of the American Chemical Society's national meeting. Dr. McMeekin is head of the protein division of the USDA's Eastern Regional Research Laboratory. His award address was on "Milk Proteins."

Karl Menger, professor of mathematics at Illinois Institute of Technology, is delivering a series of lectures on metric geometry at the Sorbonne. Dr. Menger designed the mathematics display now being installed in the Museum of Science and Industry, Chicago.

Ferdinando Morin, formerly associate professor of anatomy at the University of Genoa, Italy, has joined the staff of the Department of Anatomy, and **Ronan O'Rahilly,** lecturer in anatomy and histology at the University of Sheffield, Eng., and Ainsworth scholar in anatomy from the National University of Ireland, 1950–51, is visiting associate professor of anatomy at Wayne University College of Medicine.

Northwestern University has appointed to its faculty five staff members of Chicago area schools of nursing affiliated with its nursing education program. The appointments, which were given jointly by the College of Liberal Arts and the Medical School's Department of Medicine, included **Edna S. Newman,** of Wesley Memorial Hospital; **Miriam Dolly Rand,** of Passavant Memorial Hospital; and **Elizabeth Winnifred Odell,** of Evanston Hospital, who were named associate professors of nursing education. **Laura Bernice Chapman** and **Clare Louise Smith** were given the rank of instructor in nursing education.

The first Louis Rapkine Memorial Prize has been awarded to **Gerald Oster,** who is continuing his researches in biophysical chemistry at the Institut de Biologie Physico-chimique in Paris in the laboratories of Professor Wurmser.

Charles Steven Papp, a graduate of the University of Szeged, Hungary, and a recent arrival in this country, has become head of the Department of Entomology at Ward's Natural Science Establishment.

Dmitri Vladimirovich Skobeltzyn, with two of his colleagues, was awarded a 200,000-ruble Stalin Prize for cosmic ray studies that were said to throw new light on the nature of the atomic nucleus. Professor Skobeltzyn received one of the 82 Stalin awards in science and 59 in industry, totaling more than 11,000,000 rubles in cash benefits. Another 200,000-ruble first prize in the physics field went to **Leonid M. Brekhovskikh, Lazar D. Rosenberg,** and two other scientists for "scientific research in the field of acoustics." A 100,000-ruble second prize went to another nuclear physicist, **Yakov Petrovich Terletzky,** of Moscow University, for his work on the theory of induction expediters and the origin of cosmic rays. Important awards went also to **Boris G. Lazarev** for a "new method of enrichment of helium with light isotopes," and to **Anatoly Dorodnitzyn** and a group of other workers for research in the field of aerodynamics.

Louise Stedman, head of the Department of Home Economics, University of Maine, has been appointed director of the School of Home Economics on the St. Paul Campus of the University of Minnesota.

Harold W. Stoke, a member of the Board of Directors of the Oak Ridge Institute of Nuclear Studies since May 1949, has been named to conduct an extensive long-range study of public school teachers and their place in American society with the National Citizens Commission for the Public Schools. **Roy E. Larsen,** president of Time, Inc., is chairman of the commission. Dr. Stoke will work directly with a committee appointed by the commission. **Mrs. Barry Bingham,** vice president of the Louisville *Courier-Journal and Times* and a trustee of Radcliffe College, will head the committee.

Barton B. Wadsworth and **Edward L. Kropa** have been elected vice presidents of the Chemical Division of the Borden Company. Mr. Wadsworth has been with the division for twenty years and became assistant general sales manager in 1950. Dr. Kropa joined the Chemical Division as chemical director in 1949, prior to which he had been with the American Cyanamid Company.

Colleges and Universities

Since the publication in SCIENCE (March 16, p. 304) of the notice regarding the **ACS-Cooperative Chemistry Tests,** it has been decided that in the interests of economy the tests will be distributed through St. Louis University instead of the Educational Testing Service. For all information, write to Theo. A. Ashford, of the University's Department of Chemistry.

The **University of California at Los Angeles** will hold an Institute for Teachers of Mathematics July 9–20. W. W. Rankin, of Duke, will be the director. Registrants may earn two units of college credit. For application blanks and further details, address Clifford Bell, Mathematics Department, Los Angeles 24.

Lehigh University has received 15,000 volumes of scientific periodicals from the estate of Harvey Bassler, specialist in the geology of South America. The collection includes long runs of scientific journals such as the *Auk,* the *Botanical Gazette,* the *Kew Bulletin, Torreya,* and the *Geological Magazine,* as well as the record of the *Beagle* published by Charles Darwin.

Middlebury College Foreign Language Schools are organizing a graduate School of Spanish in Spain, which will cover Spanish linguistics, phonetics, literature, history, fine arts, and social institutions. The first semester of the 1951 academic year will be held at the University of Madrid, the second at the University of Salamanca. A preliminary summer at Middlebury College is required. For information address Samuel Guarnaccia, Middlebury College.

From June 4 through August 17, **New Mexico Highlands University** will hold special summer courses in spectroscopy, a workshop in glass blowing, and advanced work in analytical, organic, and physical chemistry, plant anatomy and physiology, bacteriology, and ecology.

Financed by the Carnegie Corporation, and as part of its centennial celebration, **Northwestern University** will offer the first U. S. Institute on Contemporary Africa June 23–August 4. The faculty will include Vernon McKay, Kenneth L. Little, Harry Rudin, Joseph Greenberg, Lyndon Harries, Paul Wingert, and M. J. Herskovits (Northwestern), to whom inquiries should be addressed. The courses will be open to qualified students in the social sciences.

Ohio State and **Ohio Wesleyan** universities will sponsor the first annual Perkins Astronomy Festival May 3–5 at the Perkins Observatory. Otto Struve will be the principal speaker, and J. Allen Hynek and John E. Merrill are co-chairmen of the event. The annual McMillin lecture will be given May 3 by Dr. Struve in the new Ohio State Physics Building.

Metallurgy of Steelmaking will be the subject of a special course at **MIT** June 13–23. It will review the principles and emphasize recent progress in practical application, under the direction of John Chipman and Nicholas J. Grant. Among the guest lecturers will be W. O. Philbrook, of Carnegie Institute; L. S. Darken and B. M. Larsen, of U. S. Steel; and M. Tenenbaum, of Inland Steel. Walter H. Gale is director of the MIT summer session.

By means of USPHS funds the Department of Philosophy and Psychology of the **University of Tennessee** has scheduled the following spring quarter visiting lecturers: George K. Bennett, The Psychological Corporation; Anne Roe, research and clinical psychologist, New York City; A. Cornelius Benjamin, Department of Philosophy, University of Missouri; Warren S. McCulloch, University of Illinois College of Medicine; Andras Angyal, Boston psychiatrist; and Clyde Kluckhohn, Harvard University Russian Research Center.

Polytechnic Institute of Brooklyn, through its Graduate School of Physics and Institute of Polymer Research is offering summer laboratory courses in x-ray diffraction, experimental methods in physical biochemistry, molecular weight and shape of polymers in solution, polymerization and copolymerization techniques, and synthesis, structure, and application of polyelectrolytes. Inquiries should be addressed to I. Fankuchen or H. F. Mark, 85 Livingston St., Brooklyn 2, N. Y.

The **University of Texas** Medical Branch, Galveston, and the **Museum of Natural History,** of Houston, have organized an expedition to the Republic of Colombia for the collection of insect vectors of tropical disease. Ludwik Anigstein and Don Micks, of the Department of Preventive Medicine and Public Health, will be among the scientists participating in the expedition.

Fellowships

The **Deutscher Akademischer Austauschdienst,** of Bonn, has offered two fellowships for American students to study in Germany November 1 to July 31. The awards are given on the basis of a national competition, and the date for receipt of applications is *May 10.* Write for information to the U. S. Student Program, Institute of International Education, 2 W. 45th St., New York 19.

Three **Lalor Fellowships** are available at the University of Delaware for graduate students in natural science, particularly areas in which chemistry and physics are applied to biological problems. Application blanks, returnable by *May 7,* may be obtained from Carl J. Rees, of the University.

The **Ferris and Florence Smith Foundation for Plastic Surgical Research,** Grand Rapids, Mich., has established a fellowship at the University of Texas Medical Branch, Galveston, for work in the Tissue Culture Laboratory. Jorge Gonzales Ramirez, of Mexico City, son of Gonzales Guzman, University of Mexico, the present holder, is working under Charles M. Pomerat, on the growth of haemangiomata.

The **American Council of Learned Societies** has inaugurated a program of awards for teachers in the humanities temporarily displaced from college and university faculties as a result of the defense emergency. Stipends for an ACLS Scholar will normally be the equivalent of the salary earned by the candidate during the academic year 1950–51, not to exceed $5,000. U. S. citizenship and a Ph.D. or its equivalent are prerequisites. For application forms write at once to Secretary for ACLS Scholars, American Council of Learned Societies, 1219 16th St., N. W., Washington 6, D. C.

A **Scripps Fellowship** is now available for research at the San Diego Zoological Society. Research is to be done on a problem that will make use of available material and be of benefit to the Zoo. Requests for further information should be addressed to Joan Morton, Biological Research Institute, S. D. Zoological Society, Box 551, San Diego 12, Calif.

Meetings and Elections

The **Association of Geology Teachers**, Central Division, held its annual meeting March 30–31, at De Pauw University. C. L. Bieber, chairman of the Department of Geology and Geography, was host. The meeting consisted of two symposia, one on the Teaching of Historical Geology and another on the Teaching of Paleontology. New officers for the 1951–52 term are: president, Grant T. Wickwire, Hanover College; vice president, Donald Boardman, Wheaton College; secretary-treasurer, R. C. Gutschick, University of Notre Dame; editor, William F. Read, Lawrence College. The organization would like to emphasize that membership is open to all teachers of geology, but it is not restricted to teachers. Nonteaching geologists, including commercial geologists, are welcome to become members. Teachers associated with geology in the secondary schools are also invited to join.

Physicians and scientists interested in attending the **Army Medical Service Graduate School's** symposium on shock May 7–9 at the Army Medical Center in Washington are asked to notify the Commandant, Army Medical Service Graduate School, Army Medical Center, Washington 12, D. C.

The sixteenth **Cold Spring Harbor Symposium on Quantitative Biology** will be held June 7–15, with "Genes and Mutations" as the topic. During the meetings, the following aspects of the problem will be discussed: Gene concept, cytoplasmic constituents of heredity, evolution of the gene, induction of changes in genes and chromosomes, genetic mechanisms in bacteria and bacterial viruses, and conclusions and perspectives. Thirty-one papers are scheduled to be given. European participants will include C. Auerbach, K. A. Bisset, and P. Koller (Great Britain); B. Ephrussi, H. Ephrussi-Taylor, and Ph. L'Heritier (France); A. Buzzati-Traverso (Italy); M. Westergaard (Denmark); G. Bonnier, A. Gustafsson, and A. Levan (Sweden); and E. Hadorn (Switzerland). Attendance will be restricted by space limitations to about 100. For program and information, address the Biological Laboratory, Cold Spring Harbor, N. Y.

The **Biological Laboratory**, Cold Spring Harbor, N. Y., is offering, for the seventh consecutive year, a summer course on bacteriophage, to be held June 25–July 14. The course will be taught by Mark H. Adams, of New York University, and is designed to acquaint research workers with some of the techniques used in work with bacterial viruses, and with recent results of such work. Following this, the course on bacterial genetics, being offered for the second year, is scheduled for July 18–August 7. Taught by E. M. Witkin, V. Bryson, and M. Demerec, this will cover selected methods used in research in bacterial genetics. Information about either course may be obtained from the Laboratory.

The **Genetics Society of America** has formed a Public Education and Scientific Freedom Committee, composed of three elected members plus the president and secretary of the society. In 1950 the three members elected were H. J. Muller (3 years); A. H. Sturtevant (2 years); and H. B. Glass (1 year). These men were elected from nine nominees each of whom submitted a prepared statement as to his idea of the purpose and function of the committee. By this method the members of the society knew the views of each candidate before voting. The vote was 518 out of a total of 813 eligible, or 64%. The committee has elected M. R. Irwin chairman.

We have been informed by the Carnegie Institution of Washington that in error they advertised the book *A Study of Classic Sculpture* (*Science*, **113**, 8, [April 6]) instead of *A Study of Classic* Maya *Sculpture*.

The **Army Chemical Replacement Training Center** will be moved about May 1 and the **Chemical Corps School** about August 15 to the newly activated Army Chemical Training Center at Fort McClellan, Alabama.

SCAP has approved another **Medical Education Team** for Japan, the organization of which has been undertaken by the Unitarian Service Committee. The present plan calls for four teams of three men each who will spend two weeks in three different medical schools, the entire group thus covering a total of twelve schools between May 14 and July 1. The team will visit the medical schools at the following universities: Keo, Tokyo, Jikei-kai, Chiba, Tohoku, Niigata, Kanazawa, Hokkaido, Kyoto, Osaka, Kobe, and Kyushu. The staff will be composed of Paul Beeson, *Chairman*, Emory University Medical School; Lauren V. Ackerman, Washington University; Daniel O. Darrow, Yale School of Medicine; Charles S. Davidson, Harvard School of Medicine; Charles G. Johnston, Wayne University; Philip Handler, Duke School of Medicine; Salvatore P. Lucia, University of California Medical Center; Robert R. Newell, Stanford School of Medicine; Maurice H. Seevers and Malcolm H. Soule, University of Michigan; and Perry P. Volpitto, Medical College of Georgia.

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Apr. 21–28. Industrial Health Conference. Atlantic City, N. J.

Apr. 29–May 3. American Association for the Advancement of Science (Southwestern Division). El Paso.

Apr. 29–May 3. Federation of American Societies for Experimental Biology (Annual). Cleveland.

Apr. 30–May 2. American Geophysical Union (Annual). National Academy of Sciences, Washington, D. C.

May 1–3. American Oil Chemists' Society. Roosevelt Hotel, New Orleans.

May 1–Sept. 30. Festival of Britain, Exhibition of Science. South Kensington, London.

May 2–3. American Meteorological Society. Washington, D. C.

May 3–4. Bone Char Conference II. National Bureau of Standards, Washington, D. C.

May 3–5. American Association of the History of Medicine (Annual). Institute of the History of Medicine, Johns Hopkins University, Baltimore.

May 3–6. Institute for Education by Radio (Annual). Deshler-Wallick Hotel, Columbus, O.

May 3–6. American Psychoanalytic Association (Annual). Netherland Plaza Hotel, Cincinnati.

May 4. Anthracite Conference (Annual). Lehigh University, Bethlehem, Pa.

May 4–5. Indiana Academy of Science. Canyon Inn, McCormick's Creek State Park.

May 4–5. Conference on Treatment of Burns. State University of Iowa College of Medicine, Iowa City.

May 4–5. North Dakota Academy of Science. University of North Dakota, Grand Forks.

May 4–11. Quinto Congreso Sudamericano de Quimica. Lima, Peru.

May 7–8. Associates Food and Container Institute (Annual). Mayflower Hotel, Washington, D. C.

May 7–8. Independent Petroleum Association of America. Denver.

May 7–9. Symposium on Shock. Army Medical Service Graduate School, Army Medical Center, Washington, D. C.

May 7–10. Liquefied Petroleum Gas Association (Annual). Stevens Hotel, Chicago.

May 7–10. National Fire Protection Association. Detroit.

May 7–11. Forest Products Research Society (Annual). Convention Hall, Philadelphia.

May 7–11. American Psychiatric Association (Annual). Cincinnati.

May 8–9. Societe de Chimie Physique (Annual). Paris.

May 9–11. The American Institute of Chemists (Annual). General Brock Hotel, Niagara Falls, Ontario.

May 9–12. U. S. National Commission for Unesco. Washington, D. C.

May 10–11. American Feed Manufacturers Association. Stevens Hotel, Chicago.

May 10–12. International Council of Industrial Editors. Congress Hotel, Chicago.

May 11–17. Exhibition of Scientific Instruments and Apparatus. Salons of the Sorbonne. Paris.

May 12–13. The Institute of General Semantics, in cooperation with the Association for the Advancement of Psychotherapy. New York State Psychiatric Institute, New York.

May 13–16. American Institute of Chemical Engineers (Regional). Hotel Muehlebach, Kansas City, Mo.

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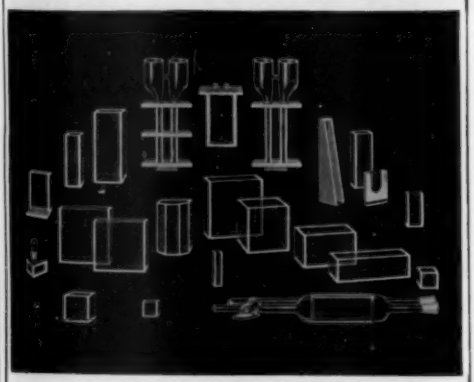

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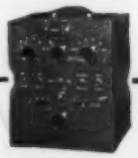

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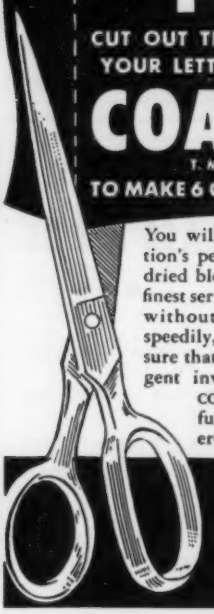

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"Mr. Bell, I heard every word you said—distinctly!" Thus, on March 10, 1876, Alexander Graham Bell (left) learned that his invention had transmitted the first intelligible speech.

75 Years of Tomorrows

Like today's telephone, Alexander Graham Bell's invention was a product of research. For several years Bell had been investigating speech and hearing, and devising methods and apparatus for the electrical communication of intelligence. No one had transmitted speech sounds electrically but Bell saw that it must be possible —given the proper instruments.

One day, while experimenting with his harmonic telegraph, Bell's alert ear caught an unexpected sound in the receiver. His trained mind told him that here at last was the proof that sound waves could travel as their facsimile in electric waves. Then followed a year of development, and in 1876, as shown above, he transmitted the first intelligible speech by telephone.

During the next three-quarters of a century, the telephone research which Bell started has grown and expanded to serve your telephone system . . . often fruitfully overflowing into other fields of electrical communication.

In today's Bell Telephone Laboratories, promising ideas find the right skills to bring them to life. Through skilled manufacturing by Western Electric Company and skilled operation by the telephone company they are brought to the service of the telephone user.

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